STRUCTURE OF MICROCARD

A01/1 = Structure of microcard

A03/1 = Special features, general instructions, safety measures, testers and tools, test specifications, tightening torques

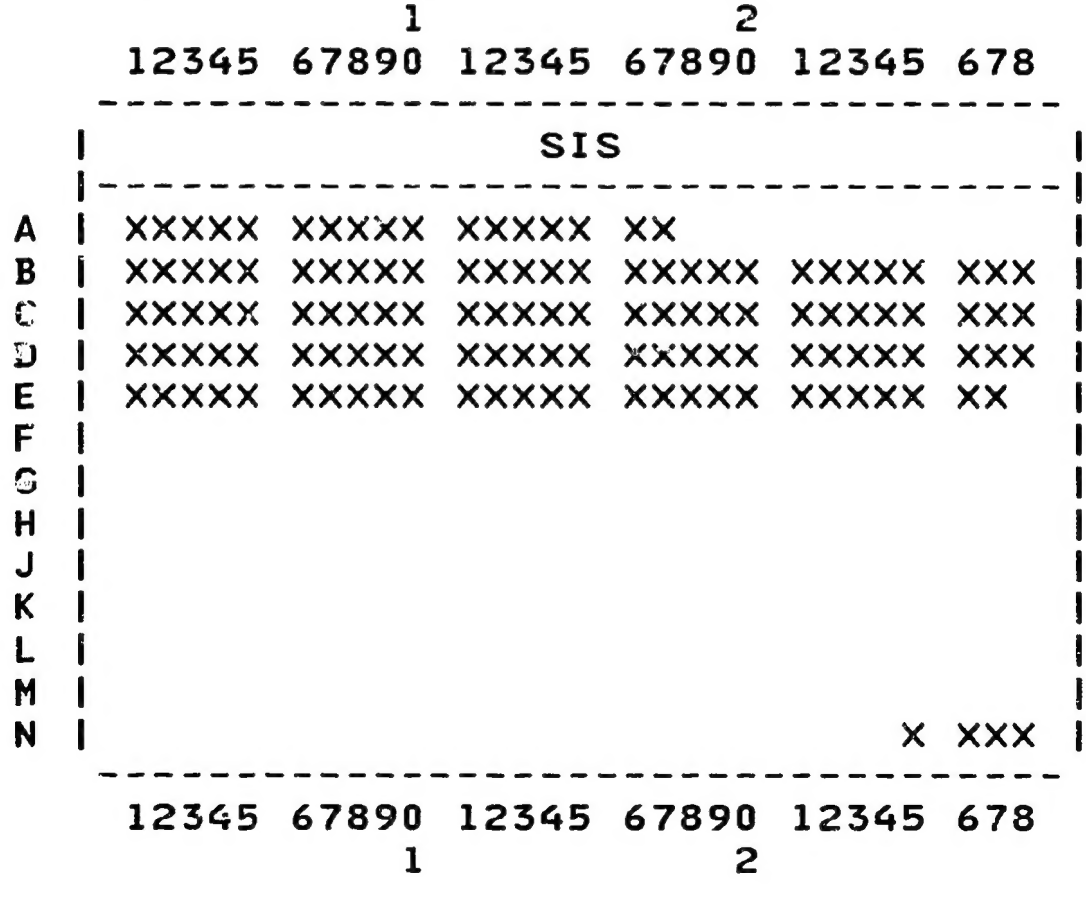
B01/1 = Repair

N25/1 = Index

N27/1 = Table of contents

N28/1 = Editorial note

Continue: A02/1 Fig.: A01/2



Continue: A02/1

DESCRIPTION OF TROUBLE-SHOOTING INSTRUCTIONS

User prompting is provided on every page e.g.:

- Continue: B17/1
- Continue: B18/1 Fig.: B17/2
- Yes: B18/1 No: B15/1
- Yes: B17/1 No: B16/1 Fig.: B15/2

.../1 = upper coordinate half
.../2 = lower coordinate half

Continue: A03/1

SPECIAL FEATURES

These instructions give a detailed description of repairing the

RE GOVERNOR POSITIONERS RE 33 AND RE 36

on size "H" in-line pumps.

The RE positioner is part of the EDC system (Electronic Diesel Control) for heavy trucks. It is mounted in place of the otherwise standard mechanical governor directly on the corresponding injection pump and forms an IP assembly together with it.

Continue: A03/2

SPECIAL FEATURES

Assignment of positioners to injection-pump series:

RE 33: Series PE(S)..H..S 1 (RP39)
Plunger stroke 18 mm

RE 36: Series PE(S)..H..S 1000 (RP43)
Plunger stroke 14 mm

Continue: A04/I

SPECIAL FEATURES

As opposed to the governor positioners RE 24/RE 30/RE 31, the positioners RE 33 and RE 36 additionally feature a prestroke solenoid which controls the start of injection of the H-pump.

Appropriate repair information is given in these instructions.

Positioner cover and housing are one part and are referred to in these instructions as positioner housing.

Continue: A05/1

GENERAL

The two positioners RE 33 and RE 36 are basically the same. Differences are merely to be found in terms of the positioner housing on account of the different installation conditions on the respective injection pump series.

Continue: A05/2

GENERAL

Special positioner versions for various vehicle manufacturers have cable bushings with overhung plug for the system electrical connection instead of the housing-fixed round screw connection.
When testing these versions on a pump test bench, it should be noted that appropriate adapter leads are required for tester connection.

Continue: A06/1

GENERAL

When performing positioner repairs, worn, damaged and electrically defective parts are always to be renewed.

The servo-magnet, rack position sensor, prestroke solenoid and plug plate with 7-pole pin terminal are installed in the positioner housing and can be replaced separately.

Continue: A06/2

GENERAL

All components are available as service parts in corrosion-proof packaging and must be kept in this packaging until they are ready for use. This applies in particular to the servo-magnet.

Complete positioners are supplied in packaging which is resistant to impact, breakage and corrosion and are likewise to be stored in the original packing.

Re-usable/new positioners are to be handled with extreme care, maintaining utmost cleanliness.

Continue: A07/1

GENERAL

Re-usable parts which are stored for lengthy periods should be covered and protected against dirt and rust.

Always renew all seals and seal rings on positioner assembly.

Continue: A08/1

SAFETY MEASURES

Component cleaning: Wash out in commercially available cleaning agent such as Chlorothene NU, which is not readily flammable, and blow out with compressed air.

Skin protection: In order to avoid the possibility of skin irritation when handling calibrating oil, oils and greases, apply hand cream before starting work and wash hands in soap and water when finished.

Continue: A08/2

SAFETY MEASURES

Safety precautions for handling flammable liquids:

* In Germany:
  Order Governing Work with Flammable Liquids (VBF) as issued by the Federal Ministry of Labor (BmA).
  Safety regulations for handling chlorinated hydrocarbons:
  - companies: ZH 1/222
  - employees: ZH 1/129
  as published by the Hauptverband für gewerbliche Berufsgenossenschaften (Zentralverband für Unfallschutz und Arbeitsmedizin),
  Langwardweg 103, 55129 Bonn.

Continue: A09/1

SAFETY MEASURES

Safety regulations when handling flammable liquids (continued):

* In all other countries:

  In all other countries the local regulations are to be observed.

Continue: A09/2

SAFETY MEASURES

When repairing and testing injection pump/positioner make exclusive use of the special tools and testers listed in these instructions/in the product-related instructions.

If use is made of incorrect/unsuitable tools and testers, there is a danger of injury/damage to products and component parts.

Continue: A10/1

TESTERS, FIXTURES AND TOOLS

A list is given of the testers, fixtures and tools required for RE positioners.

Standard H-pump fixtures and tools as well as commercially available tools are not given.

The special equipment needed for every IP assembly for test-bench checking is indicated on the respective test-specification sheet.

Continue: A10/2

TESTERS, FIXTURES AND TOOLS

* Universal test lead (connection of test control unit in conjunction with the following version-specific adapter leads)	0 986 610 102 KDEP-P 400/2

Continue: A11/1

TESTERS, FIXTURES AND TOOLS

* Adapter leads for version-specific positioner connection:	
- Housing-fixed round screw connection	0 986 610 104 KDEP-P 400/3
- Cable outlet with overhung Schlemmer plug (MAN)	0 986 610 107 KDEP-P 400/6

Continue: A11/2

TESTERS, FIXTURES AND TOOLS

* Regulator 12 V/15 A (adjustable current output) for servo-magnet actuation	commercially available
* Multimeter (digital multimeter) Measuring resistance at positioner components	commercially available
* CRT measuring device	1 688 130 130

Continue: A12/1

TESTERS, FIXTURES AND TOOLS

* Setting gauge for checking position of RPS short-circuiting ring	0 986 612 620
* Puller for disk cam	0 986 618 245 KDMZ 6999
* Start of delivery blocking device, for fixing pulse wheel	0 986 611 746 KDEP 1077

Continue: A12/2

TESTERS, FIXTURES AND TOOLS

* Measuring device for adjusting prestroke solenoid in RE positioner	0 986 612 657
Plus:	
- Cover (with threaded mount)	0 986 612 676
- Dial-indicator holder	1 688 130 030
- Dial indicator Range 30 mm Graduations 0.01 mm	1 687 233 012

Continue: A13/1

TESTERS, DEVICES AND TOOLS

* Pin-type socket wrench for counter-holding plastic seal for rack-position sensor when drilling out (plastic seal in newer positioners instead of steel closure cap)	0 986 611 459 KDEP 2990
* Guide pin (set = 2 x) for installing cover on positioner housing	0 986 612 598 KDEP 1910

Continue: A13/2

TESTERS, DEVICES AND TOOLS

Illuminated magnifier min. 6x magnification	comm. avail. or Bosch 1 987 600 005
or Workshop microscope, 10x magnification	comm. avail.

For visual assessment of crimps on 7-pin terminal board in positioner.

Continue: A14/1

TESTERS, DEVICES AND TOOLS

* Soldering iron
  for soldering and
  unsoldering leads on
  7-pole connection
  plate commercially available

Requirements:
- Temperature regulation
- Soldering tip temperature
  350...370 degrees C
- Power approx. 50 W

Recommendation:
- Weller soldering station
  WTCP-S with
- soldering iron TCP-S 24 V, 50 W
- Soldering tip No. 7,
  Long, tapered, 370 degrees C

Continue: A14/2

TESTERS, DEVICES AND TOOLS

* Soldering tin:
  With no bismuth or cadmium
  content.

  Recommended soldering tin:
  DIN Sn60 Pb Cu2 or Sn63 Pb.

  Recommended flux:
  IN F-SW 26 (2.5%) or
  in USA: Type RMA 2...3% QQ-S-571

Continue: A15/1

TEST SPECIFICATIONS

There is a test-specification sheet, which is to be determined according to combination number and table of contents, for every injection-pump assembly with
RE positioner. This test-specification sheet contains all the necessary test specifications and settings.

These repair instructions therefore only encompass generally valid values which are the same for all positioners.

Continue: A15/2

TEST SPECIFICATIONS

General test specifications:

Positioner with housing-fixed round-plug connection:

Resistance measurements at positioner, pin:

1-6	(RPS coil 1)	17...23 Ohm
6-5	(RPS coil 2)	17...23 Ohm
1-5	(RPS total)	34...46 Ohm
2-7	(Servo-magnet)	0.55...0.90 Ohm
3-4	(Prestroke sol.)	1.10...1.55 Ohm

Continue: A16/1

TEST SPECIFICATIONS

General test specifications:

Positioner with cable bushing and
overhung Schlemmer plug:

Resistance measurements at plug, pin:

1-6	(RPS coil 1)	17...23 Ohm
5-6	(RPS coil 2)	17...23 Ohm
1-5	(RPS total)	34...46 Ohm
7-8	(Servo-magnet)	0.55...0.90 Ohm
3-4	(Prestroke sol.)	1.10...1.55 Ohm

2 - not used

Continue: A16/2

TEST SPECIFICATIONS

General test specifications:

Dimension "X" (thrust pin
of servo-magnet armature): 0.1...0.3 mm

Continue: A17/1

ADHESIVES, LUBRICANTS, MATERIAL DESIGNATION

* Locking compound for positioner and component fastening screws	Loctite 242 (blue, red bottle)
* Molycote grease for RPS clamping screw Molycote M55 Plus	5 903 060 000

Continue: A18/1

TIGHTENING TORQUES

Positioner - pump housing (8 screws):	7...9 Nm
Prestroke solenoid closing cover (4 screws):	9...11 Nm

Continue: A18/2

TIGHTENING TORQUES

Servo-magnet backing plate (2 screws):	9...11 Nm
7-pin positioner plug plate (3 screws):	9...11 Nm
RPS tensioning screw (tighten quickly and evenly):	15...18 Nm
Fastening nut Pulse wheel on camshaft (taper 20 mm):	90...100 Nm

Continue: B01/1

POSITIONER DISASSEMBLY

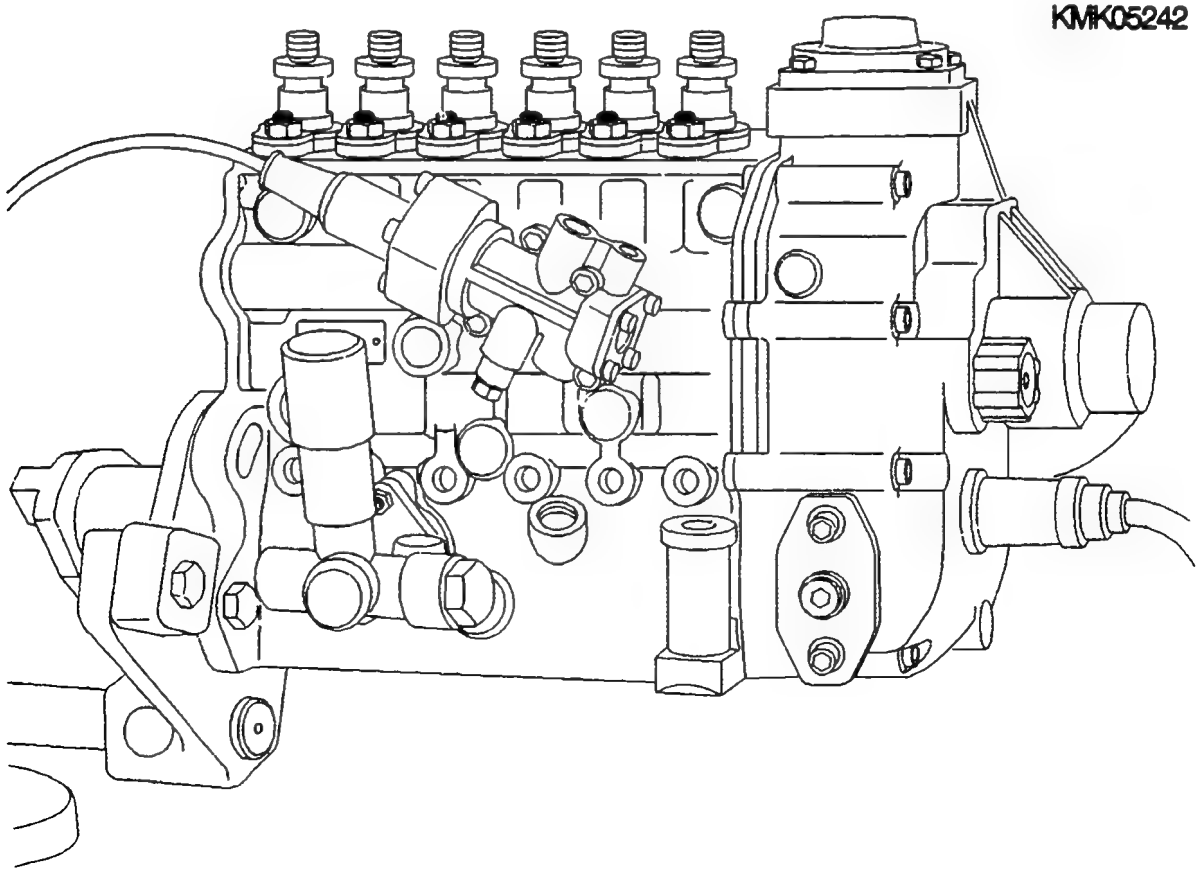
Assemble injection pump complete with RE positioner on swivel-type frame 0 986 611 248 (KDEP 2919). The choice of clamping device is governed by the pump design:

* Flange mounting: Clamping bracket 0 986 611 358, fastening flange as per pilot.

* Flat and cradle mounting: Holder 0 986 611 441 in conjunction with clamping device 0 986 612 649.

Fig.: Pump with flange mounting.

Continue: B02/1 Fig.: B01/2



POSITIONER DISASSEMBLY

Mount drive coupling on taper,
drive end:

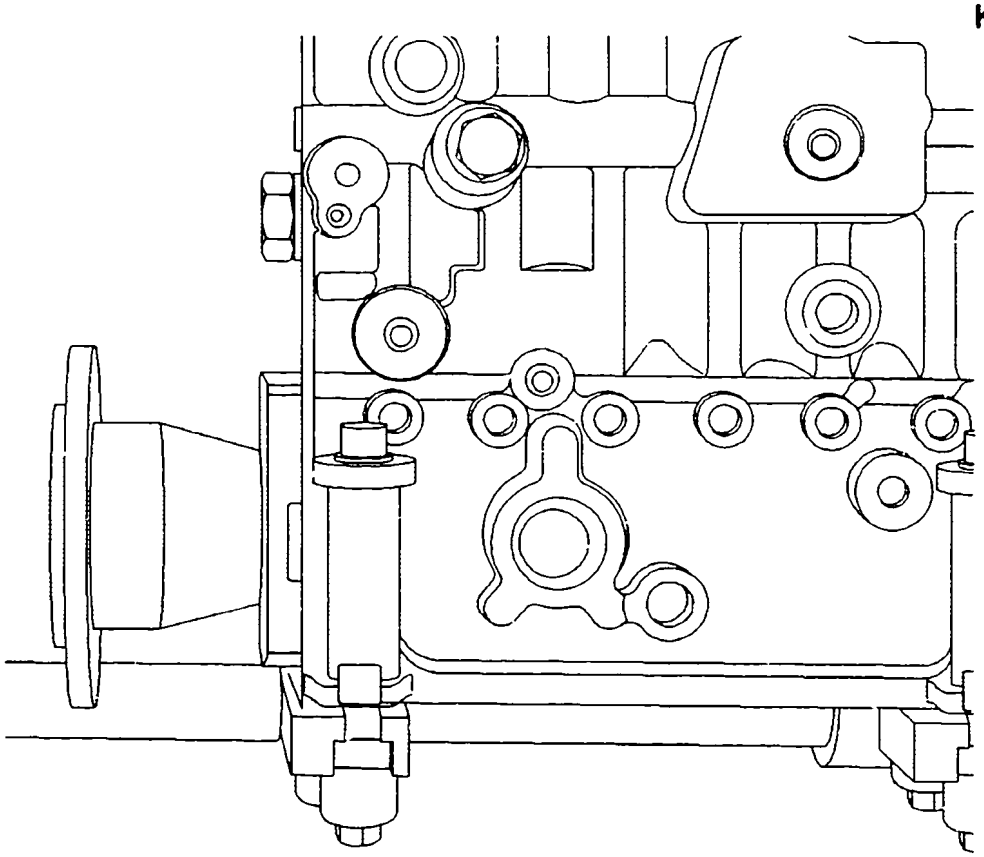
RP 43 (taper 35 mm):
- Taper length 28 mm: 1 686 430 038
- Taper length 36 mm: 1 686 430 040

(Two-jaw version)

RP 39 (taper 40 mm):
- Taper length 28 mm: 1 685 702 075
- Taper length 41 mm: 1 685 702 076

(Flange version)
Plus:
- Hook wrench 1 687 950 530

Continue: B03/1 Fig.: B02/2



POSITIONER DISASSEMBLY

Unfasten screw plugs of start of delivery bore.

Remove sealing wires/plastic seals of positioner fastening screws.
Note: It is advisable to memorize the different plastic-seal assembly locations for the various positioners.

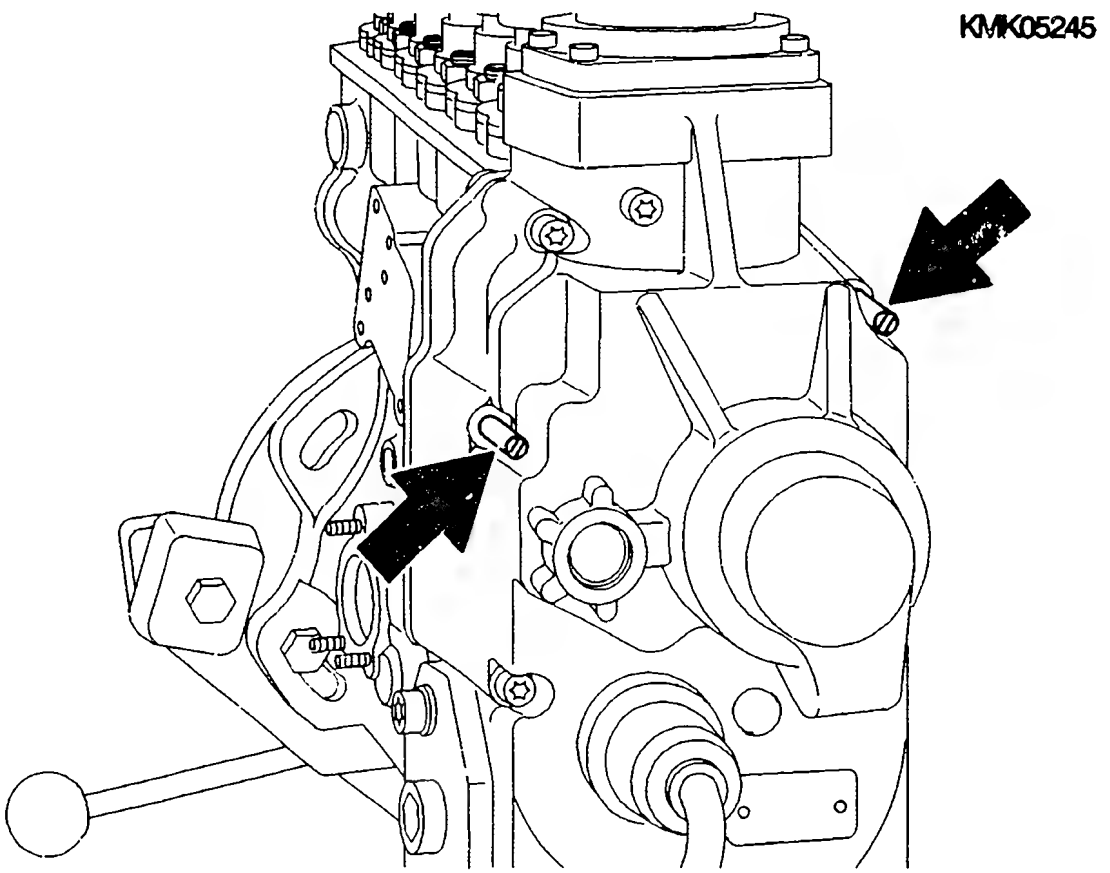
Continue: B04/1

POSITIONER DISASSEMBLY

Removing RE positioner from pump housing:

Screw out 2 opposing positioner fastening screws and replace them with the 2 guide pins 0 986 612 598.

Continue: B05/1 Fig.: B04/2

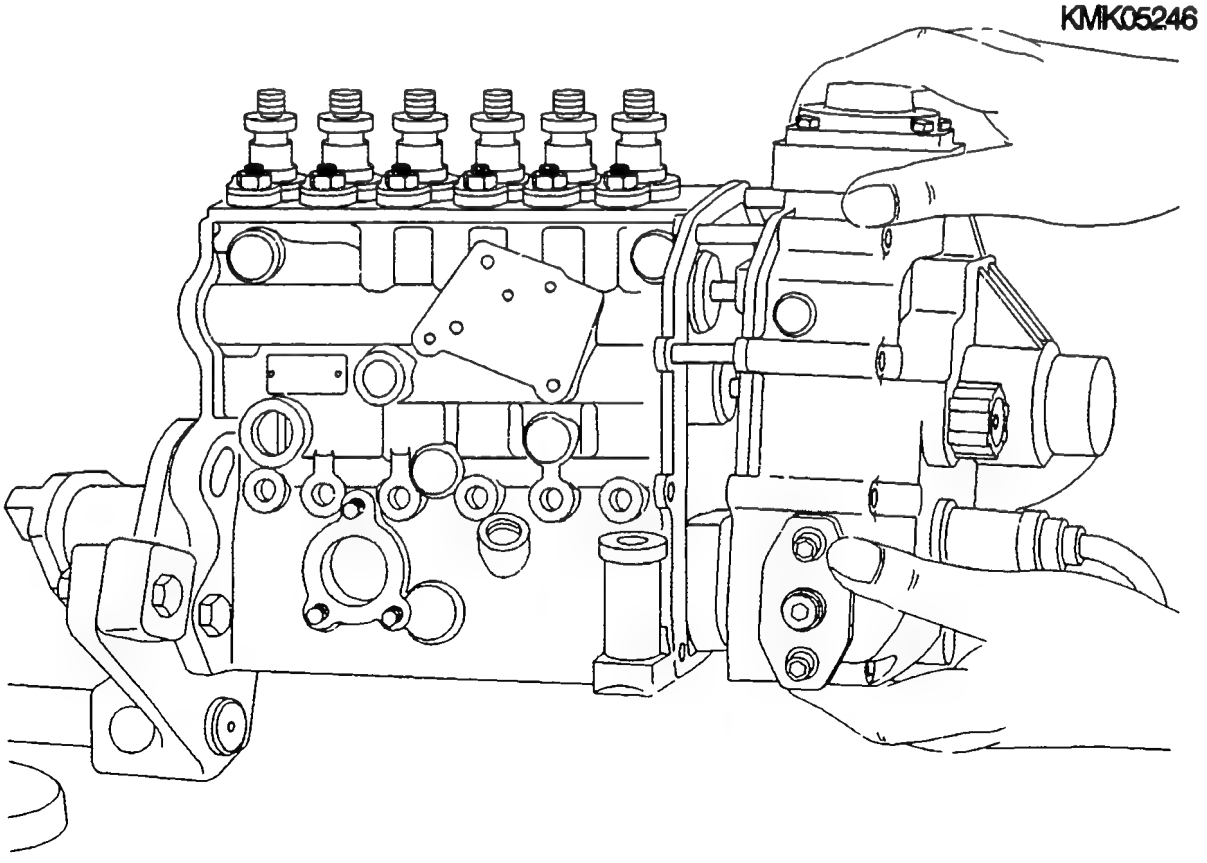


POSITIONER DISASSEMBLY

Screw out remaining positioner fastening screws and remove complete positioner via guide pins in axial direction. Catch residual oil.

Proceed with caution so as not to damage short-circuiting ring of RPS and measuring arms or control lever of prestroke shaft.

Continue: B06/1 Fig.: B05/2



POSITIONER DISASSEMBLY

Removing disk cam and viscous oil pump:

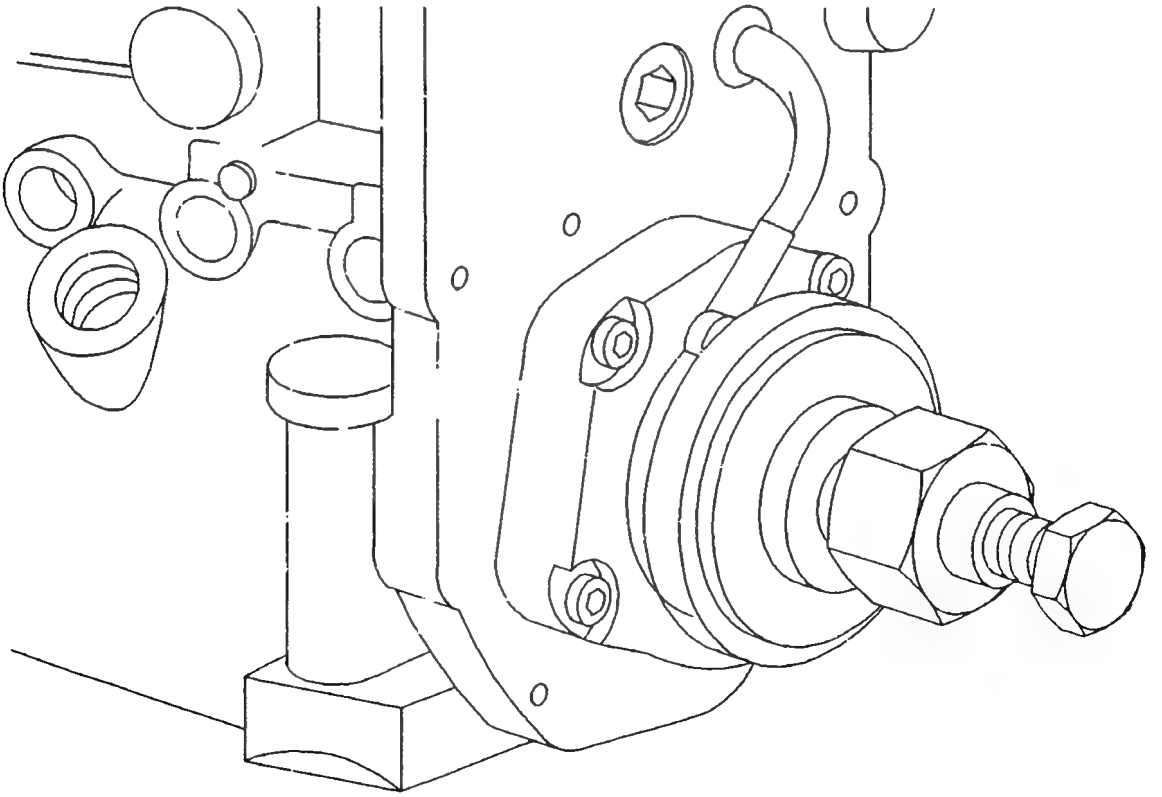
Counter-hold with holding wrench
0 986 611 084 at drive coupling and unscrew fastening nut of disk cam at camshaft taper.

Remove disk cam with puller
0 986 618 245 from taper of camshaft.

Pull hose of oil pump off nipple of pump housing and remove oil pump with spring from bearing flange.

Continue: B07/1 Fig.: B06/2

KMK05247

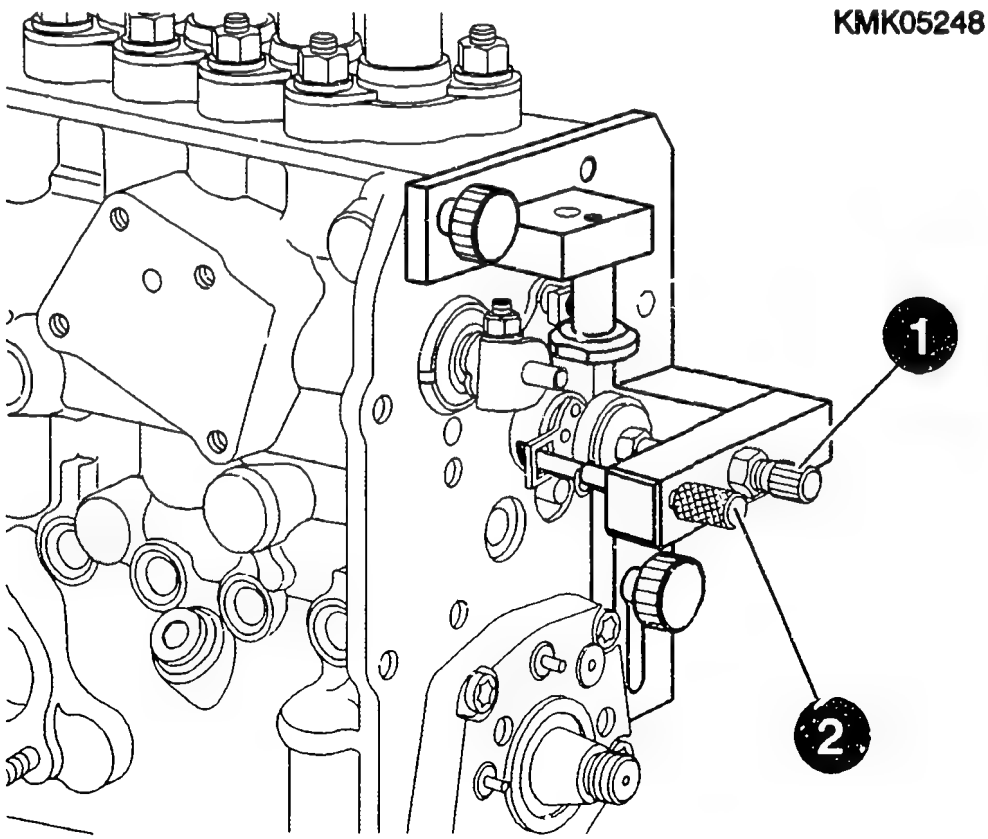


POSITIONER DISASSEMBLY

Checking position of RPS short-circuiting ring:

Prior to further disassembly of injection pump, check position of RPS short-circuiting ring at control rod with setting device 0 986 612 620. This is necessary since its position cannot be checked on the subsequently removed control rod (complete unit with bushing, spring, plate washer with ring and cap nut).
1 = Adjusting screw, 2 = Measuring rod

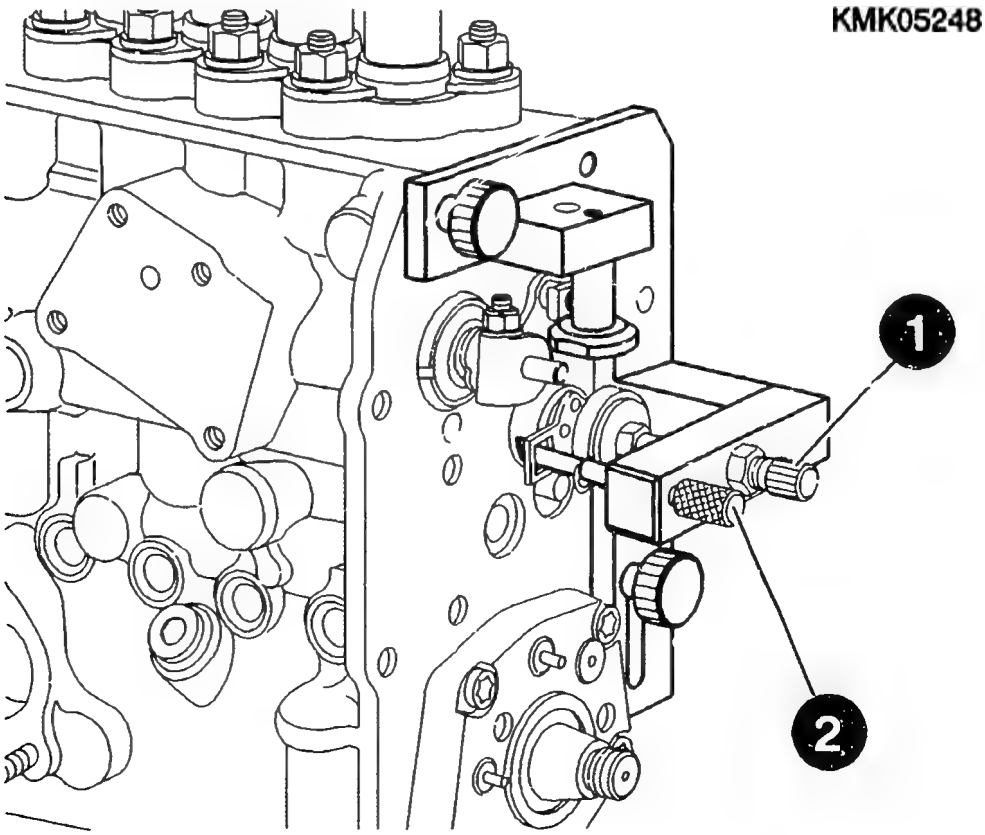
Continue: B08/1 Fig.: B07/2



POSITIONER DISASSEMBLY

Checking position of RPS short-circuiting ring:
Before attaching setting device, stop bracket for control lever of pre-stroke shaft may have to be removed for space reasons.
Support setting device at positioning pin at top right of pump housing and screw into the appropriate tapped holes in the housing using the two knurled screws.
Set control rod with adjusting screw (1) to roughly (estimate) half travel.
Check position of ring with measuring rod (2).

Continue: B09/1 Fig.: B08/2



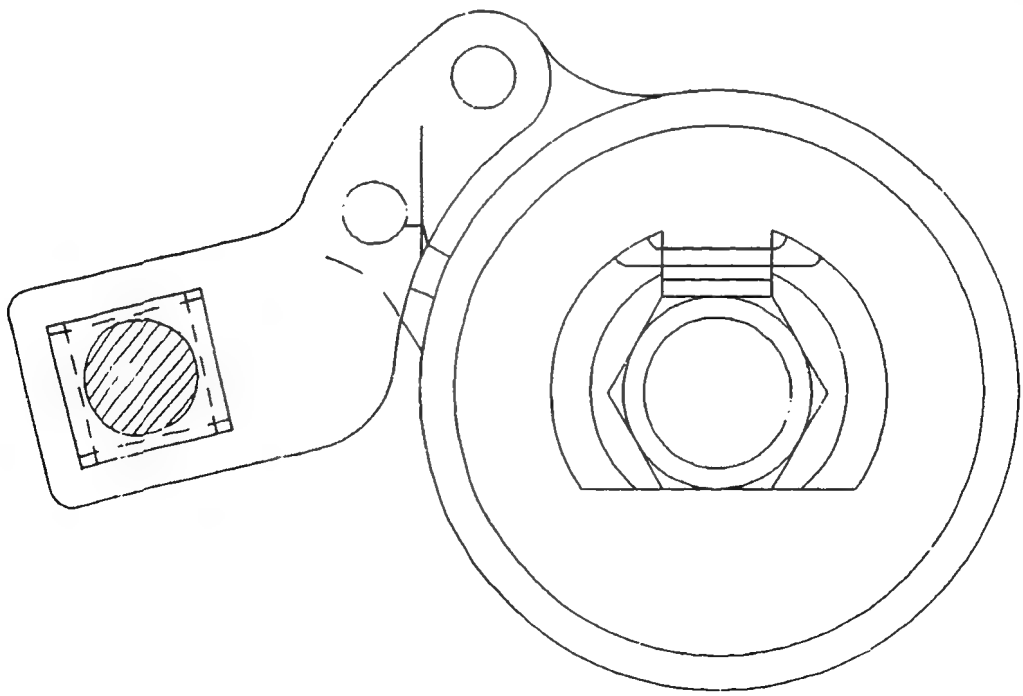
POSITIONER DISASSEMBLY

Checking position of RPS short-circuiting ring:
It must be possible to insert the measuring rod without resistance even if the control rod is turned and released again.

If the position of the ring does not correspond to that of the setting device, the control rod (complete unit) is to be replaced or scrapped on pump repair.

Continue: B10/1 Fig.: B09/2

KMK05249



COMPONENT CLEANING AND CHECKING

Wash out parts in commercially available cleaning agent such as Chlorothene NU, which is not readily flammable and then blow out with compressed air.

Important:

When cleaning the positioner cover, it must be ensured that cleaning agent does not enter the armature gap, the vent duct of the servo-magnet and the armature gap of the prestroke solenoid.

Continue: B11/1

SAFETY MEASURES

Safety regulations for handling chlorinated hydrocarbons

Companies	ZH 1 / 222
Employees	ZH 1 / 129

as published by the Main Body of the Liability Insurance Associations (Central Association for Accident Prevention and Industrial Medicine) Langwartweg 103, 53129 Bonn.

In all other countries the local regulations are to be observed.

Continue: B12/1

COMPONENT CLEANING AND CHECKING

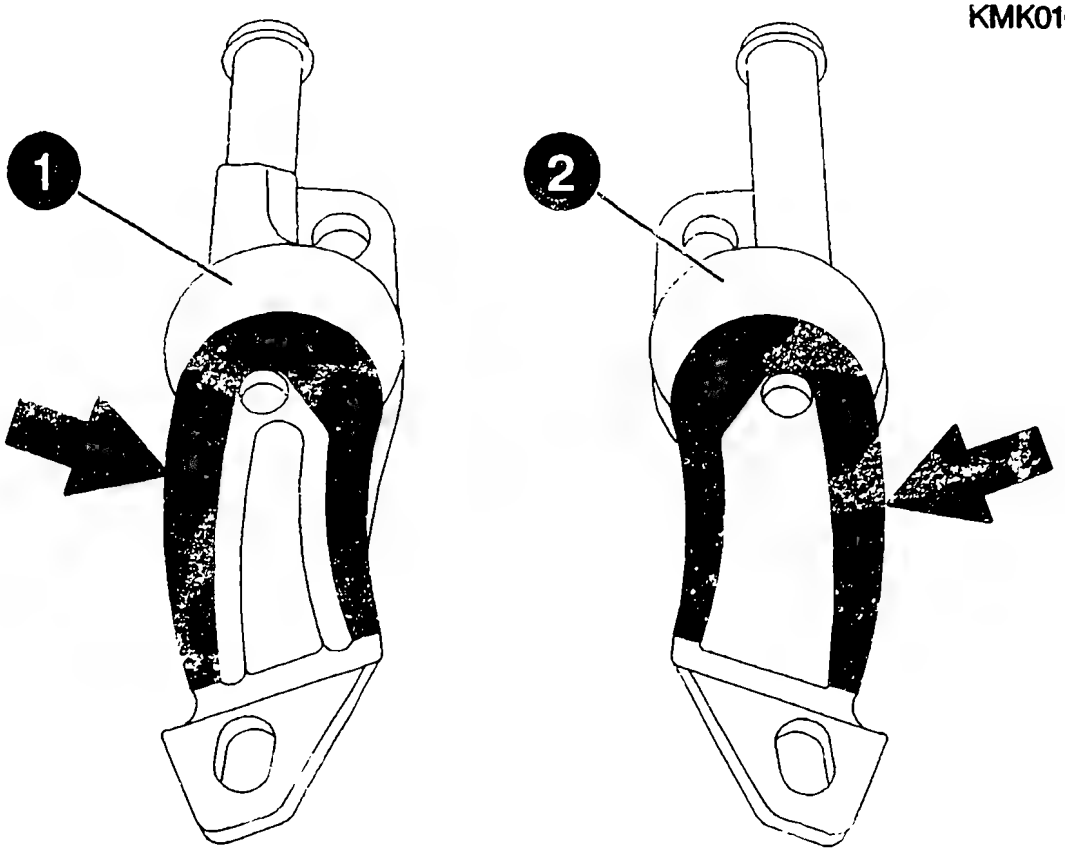
Oil pump (viscous pump):

Replace oil pump with damaged/scored bearing surface (arrows).

Note:
Up to approx. mid 1994 oil pumps with different housing curvature were installed depending on the direction of rotation of the injection pump: For counter-clockwise (fig. 1), mounted on left as viewed from disk cam end; for clockwise, mounted on right (fig. 2). The corresponding oil hoses likewise differ.

Continue: B13/1 Fig.: B12/2

KMK01017



COMPONENT CLEANING AND CHECKING

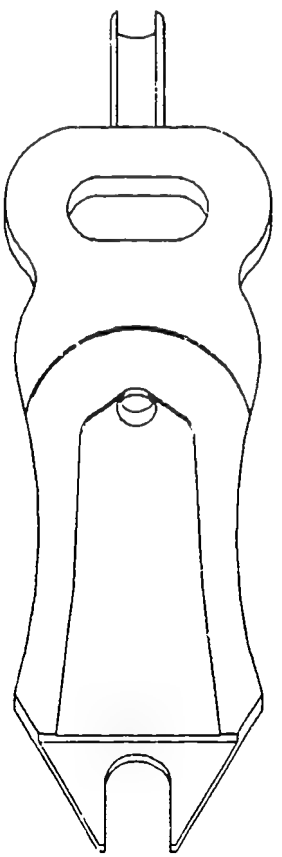
Installing oil pump (viscous pump):

As of approx. mid 1994 there is only one standard oil pump which is independent of direction of rotation. The correct installation side in line with the notes on the previous Coordinate is however still to be heeded.

The new version can also be installed in place of the direction-dependent version.

Continue: B14/1 Fig.: B13/2

KMK05292



COMPONENT CLEANING AND CHECKING

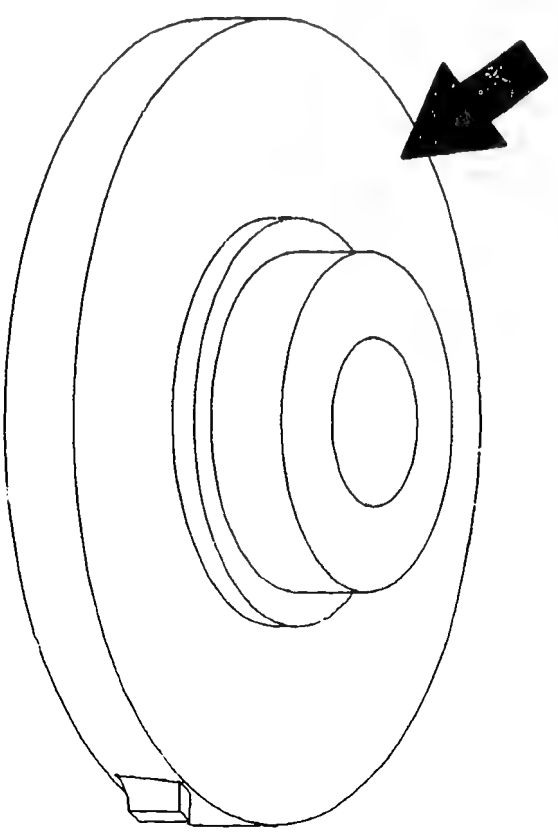
Disk cam:

The ground bearing surface for the oil pump on the back of the disk cam (arrow) must not be damaged or scored.

Replace disk cam if necessary.

Continue: B15/1 Fig.: B14/2

KMK05293



POSITIONER HOUSING - TESTING

The positioner housing accommodates all electrical components

- Servo-magnet
- Prestroke solenoid
- RPS
- 7-pin plug plate.

These components are to be checked and can be replaced separately if faulty.

Continue: B15/2

POSITIONER HOUSING - TESTING

Visual inspections:

The positioner housing and the components installed in it must be free from dirt and chips.

The individual components and the sealing surface of the positioner housing must not reveal signs of mechanical damage.

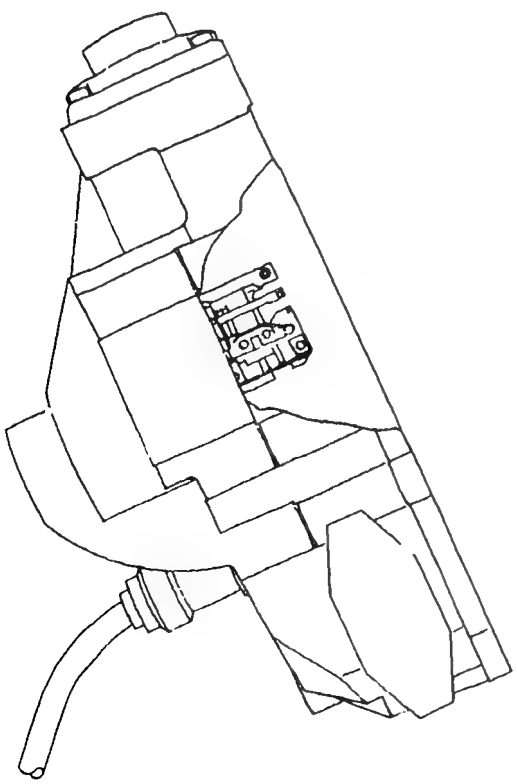
Testing of the individual components is described in the following.

Continue: B16/1

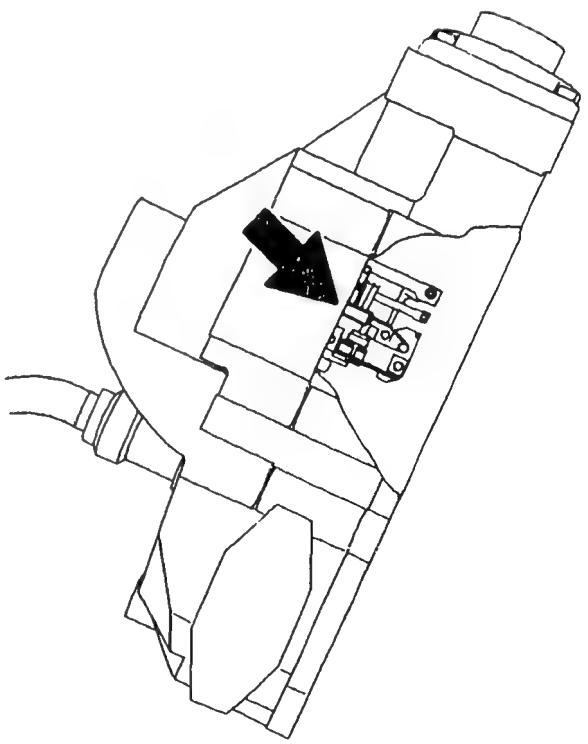
POSITIONER HOUSING - TESTING

Checking freedom of movement of servo-magnet (in situ):
When the positioner housing is inclined approx. 30 degrees from the perpendicular (approx. 30 degree magnet tilt) in both directions, the weight of the armature must cause it to slide to the respective stop.
If this is not the case, remove magnet, clean armature and armature bore and lubricate both liberally with SAE 20 W 20 engine oil. Replace magnet if this does not produce freedom of movement.
For removal and installation refer to Coordinate: C05/1

Continue: B17/1 Fig.: B16/2



KMK05556



POSITIONER HOUSING - TESTING

Checking freedom of movement of servo-magnet:

Important:

Checking the freedom of movement of the armature as described above does not involve removing the magnet. This suffices if the fuel-injection pump is not specifically thought to be sticking. One-sided wear of the armature bush such as may occur after lengthy running may result in stiffness during operation, which cannot be detected in the course of this test.

Continue: B17/2

POSITIONER HOUSING - TESTING

Important:
Removal of the magnet and precise measurement of the bearing clearance are an absolute must in the case of pumps with many hours of operation, general overhaul or a specific complaint about "unstable engine idling behavior" (in the event of considerable instability combined with the fault message "Permanent system deviation").

For removal and installation of magnet refer to Coordinate: C05/1

For measurement procedure refer to following Coordinate.

Continue: B18/1

POSITIONER HOUSING - TESTING

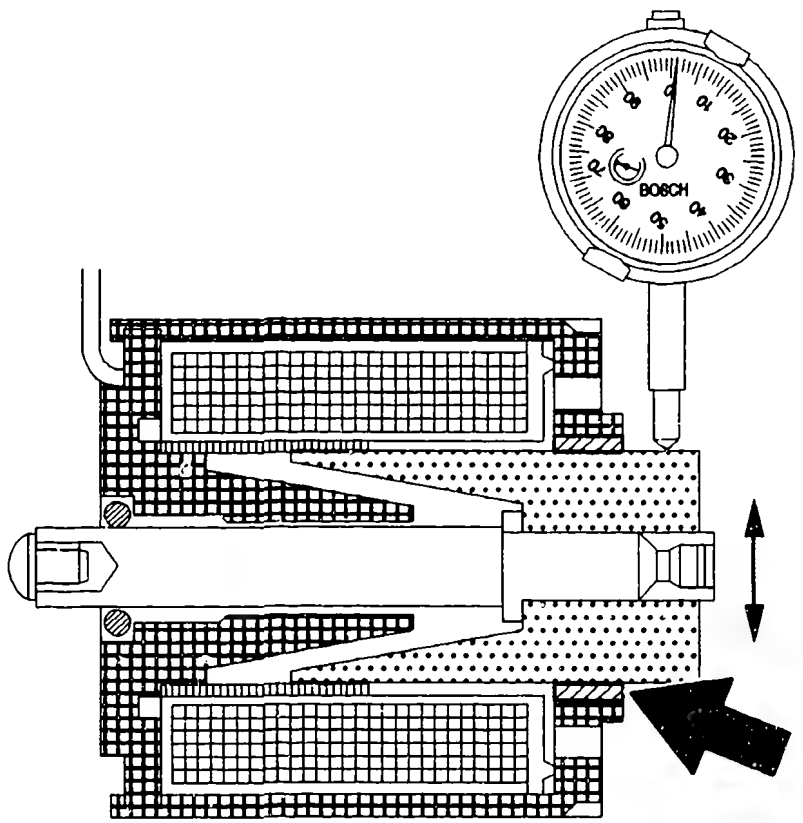
Checking large bearing bush in servo-magnet (arrow) for wear:

To perform check, place magnet in prism and pull out armature slightly. Position dial indicator (e.g. 1 687 233 011) with stand (e.g. 4 851 601 124) on armature. Move armature up and down whilst simultaneously turning magnet in prism and thus measure maximum bearing clearance.

The maximum bearing clearance of the large bush may be 0.16 mm. Magnet is to be replaced if this value is exceeded.

Continue: B19/1 Fig.: B18/2

KMK03078



POSITIONER HOUSING - TESTING

Prestroke solenoid:

Connect up actuation lead for pre-stroke solenoid to regulator 12 V/15 A (adjustable) - two-core lead to positioner.
Plug, green --> (+)
Plug, blue --> (-)
Slowly increase current. As of approx. 3.0 A armature must start up slowly and smoothly.
Full-scale armature deflection is reached at a current of approx. 6.0...6.5 A.
For removal and installation refer to Coordinate: C05/1

Continue: B20/1

POSITIONER HOUSING - TESTING

RPS, mechanical testing:

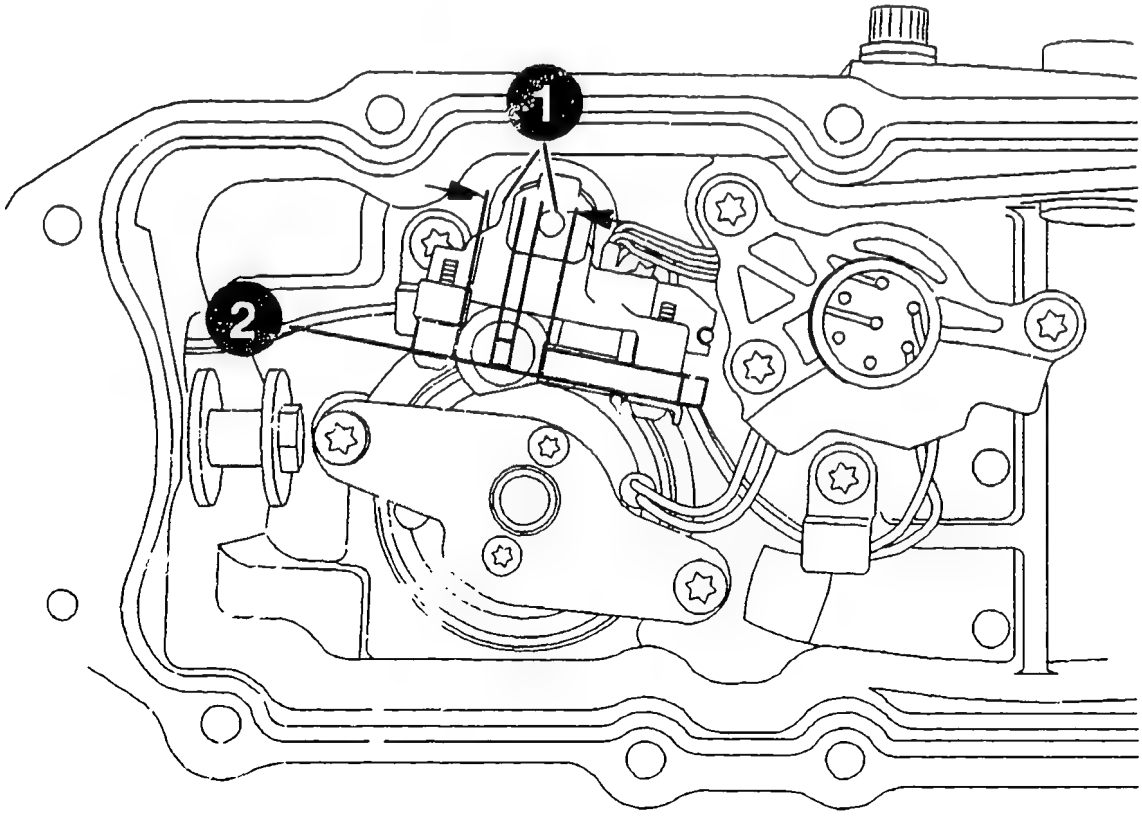
The RPS must not show signs of mechanical damage or bending.

The measuring arm must be centered with (1) and in alignment with (2) the two outer arms.

Is the RPS in proper mechanical working order?

Yes: B22/1 No: B21/1 Fig.: B20/2

KMK05558



POSITIONER HOUSING - TESTING

Replace damaged RPS.
Pay attention to removal and installation instructions as of
Coordinate: C05/1

Continue: B22/1

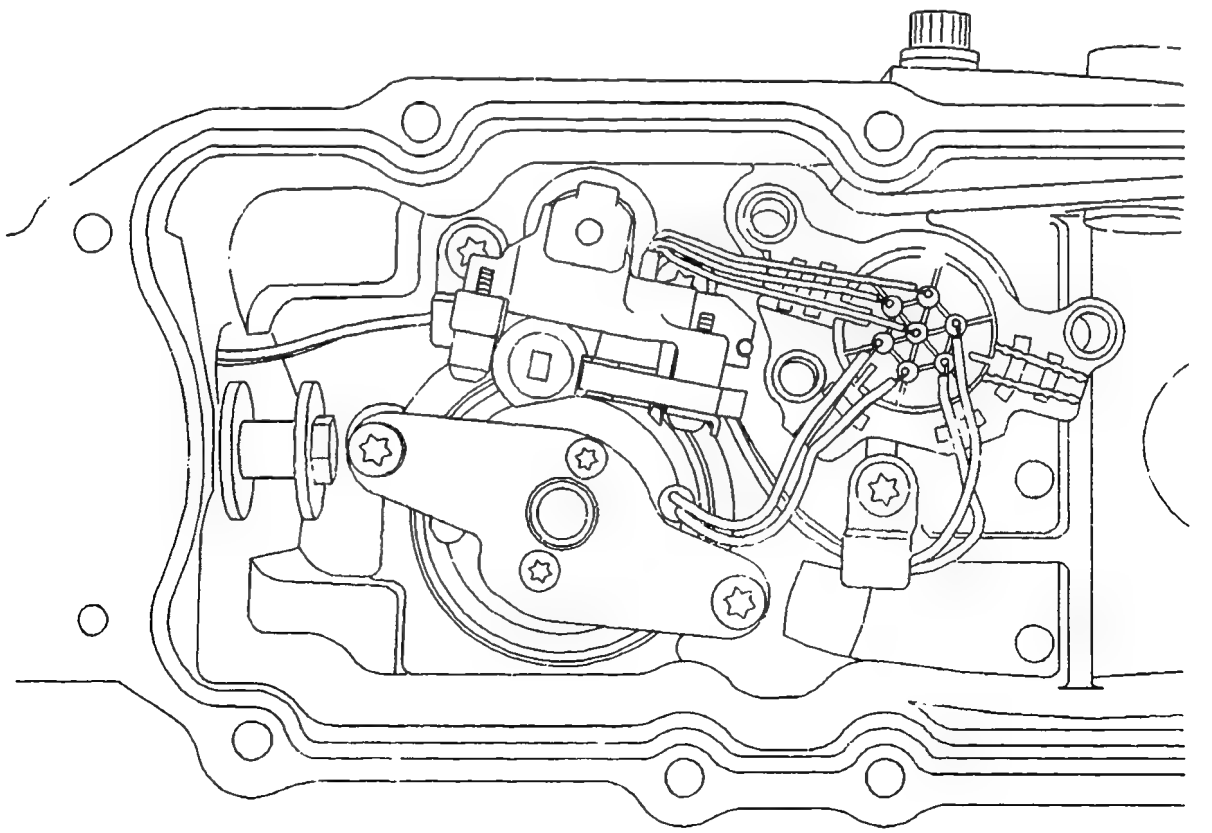
POSITIONER HOUSING - TESTING

Electrical positioner connections, inner:

Check proper condition of soldered joints, strength of soldering-tab crimps on leads and proper condition/ proper laying of leads. In case of doubt, joints are to be resoldered. Where necessary, replace appropriate component if leads are damaged. Refer to repairing positioner housing as of Coordinate: C05/1

Continue: B23/1 Fig.: B22/2

KMK05569



POSITIONER HOUSING - TESTING

Electrical positioner connections, inner:

Additionally check strength of lead crimps in soldering tabs by way of visual assessment:

Visual assessment involves the use of an illuminated magnifier (min. 6x magnification, e.g. Bosch 1 687 600 005) or a workshop microscope (with 10x magnification).

Particular attention is to be paid to the crimps of the thinner RPS leads.

Continue: B24/1

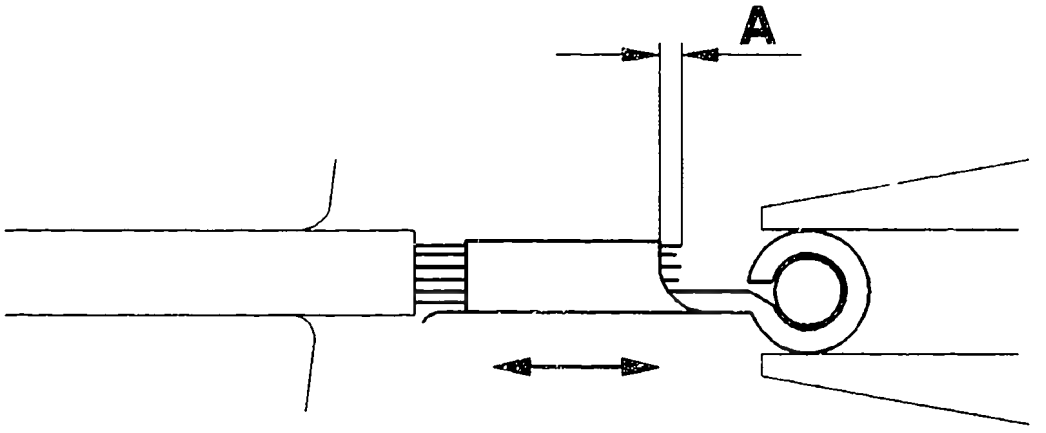
POSITIONER HOUSING - TESTING

Electrical positioner connections, inner:

- Unscrew cover plate of 7-pin terminal board.
- Remove residual oil from area around lead crimps.
- Lift each RPS lead out of cable duct and move back and forth with pointed pliers or tweezers in stranded-wire direction whilst observing crimp under magnifier/microscope.
  While doing so, hold soldering tabs with pliers. Take care not to kink leads.

Continue: B25/1 Fig.: B24/2

KMK04056



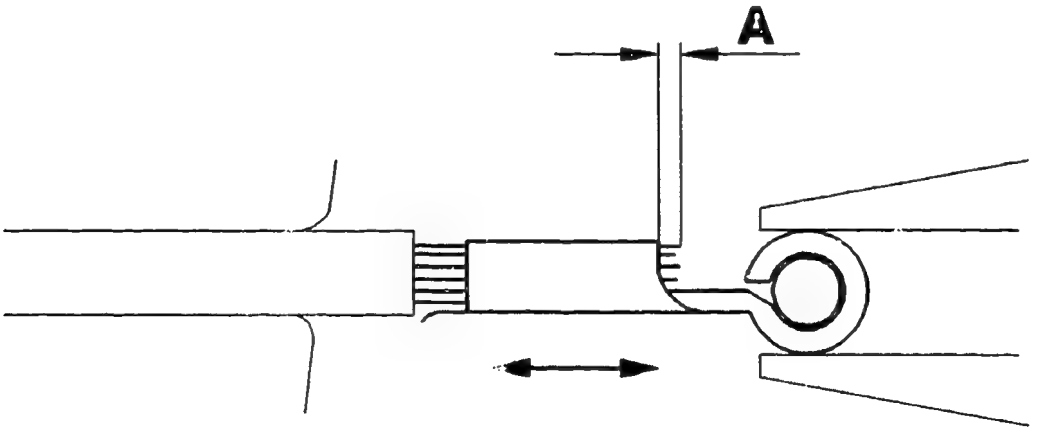
POSITIONER HOUSING - TESTING

Electrical positioner connections, inner:

- Moving the lead must not alter the length of the projecting end of the stranded wire (dimension A, see fig.). The crimp connection is defective if there is the slightest discernible relative movement between end of stranded wire and crimp.
- Note: The distance between crimp and lead insulation is not suitable for assessment purposes on account of its flexibility.
  Corresponding component is to be replaced if crimp connection is loose.

Continue: B26/1 Fig.: B25/2

KMK04056



POSITIONER HOUSING - TESTING

Electrical positioner connection, outer:

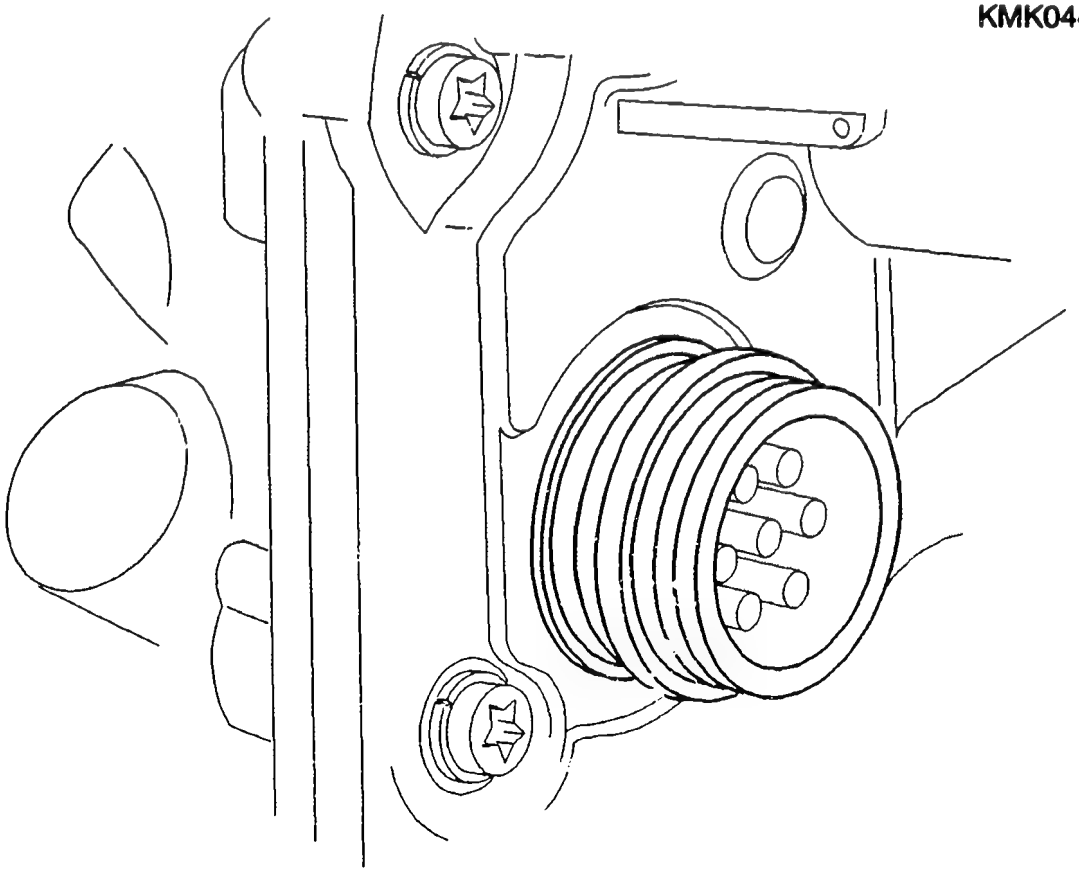
Positioner version with housing-fixed round screw connection:

Check thread for damage (e.g. as a result of connector cap nut being fitted at an angle). Rework thread if necessary or replace entire plug plate.

Refer to repairing positioner housing, Coordinate: C05/1

Continue: B27/1 Fig.: B26/2

KMK04476



POSITIONER HOUSING - TESTING

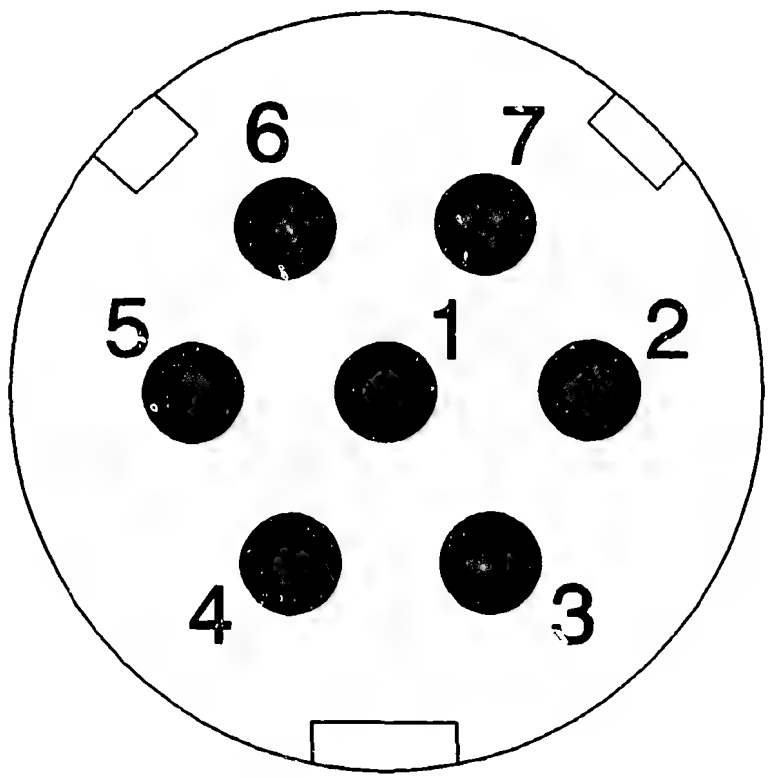
Positioner with housing-fixed round screw connection:

Check contact pins in plug housing for corrosion and erosion (caused for example by loosely fitted connector). Replace entire plug plate if necessary. Refer to repairing positioner housing, Coordinate: C05/1

Note: Avoid mechanical cleaning of contact pins, as this damages the surface coating.

Continue: B28/1 Fig.: B27/2

KMK01023



POSITIONER HOUSING - TESTING

Positioner version with cable bushing and overhung plug:

Check lead and plug for mechanical damage. Check contacts for corrosion and erosion.
If necessary, replace entire cable bushing with plug. Refer to repairing positioner housing,
Coordinate: C05/1

Continue: C01/1

POSITIONER HOUSING - TESTING

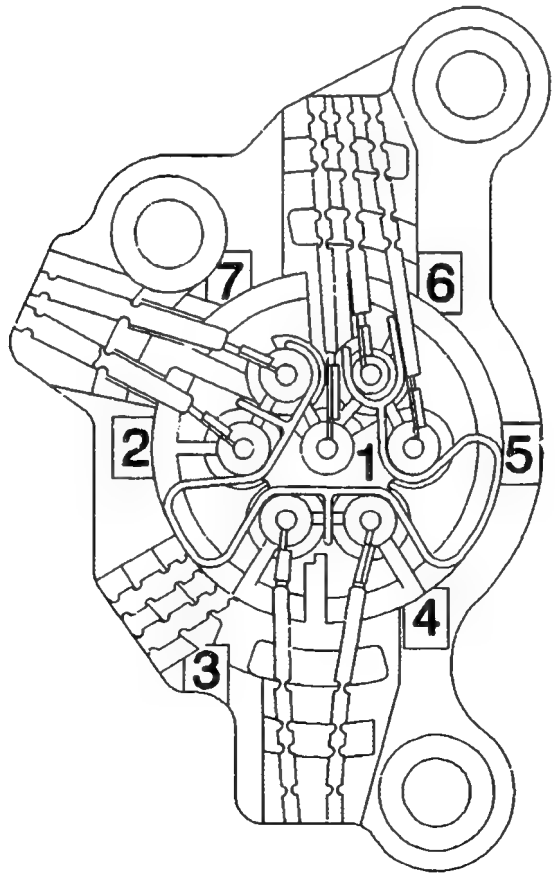
Resistance measurement for individual components at 7-pin positioner connection - solder side:

1-6 (RPS coil 1)	17...23	Ohm
5-5 (RPS coil 2)	17...23	Ohm
1-5 (RPS total)	34...46	Ohm
2-7 (Servo-magnet)	0.55...0.90	Ohm
3-4 (Prestroke sol.)	1.10...1.55	Ohm

If resistances are outside tolerance:
Replace component concerned.
Refer to Coordinate: C05/1

Continue: C02/1 Fig.: C01/2

KMK004477



POSITIONER HOUSING - TESTING

In the case of positioner version with cable bushing and overhung plug, check leads from plug to terminal board for continuity and mutual short circuit. Refer to following Coordinates for plug assignment.
Test specifications:
Continuity test: 0 Ohm.
Mutual short circuit: infinity Ohm
Note on short-circuit test: When mutually checking leads to a component, the value is not infinity Ohm, but rather in line with the coil resistance of the component.

Continue: C03/1

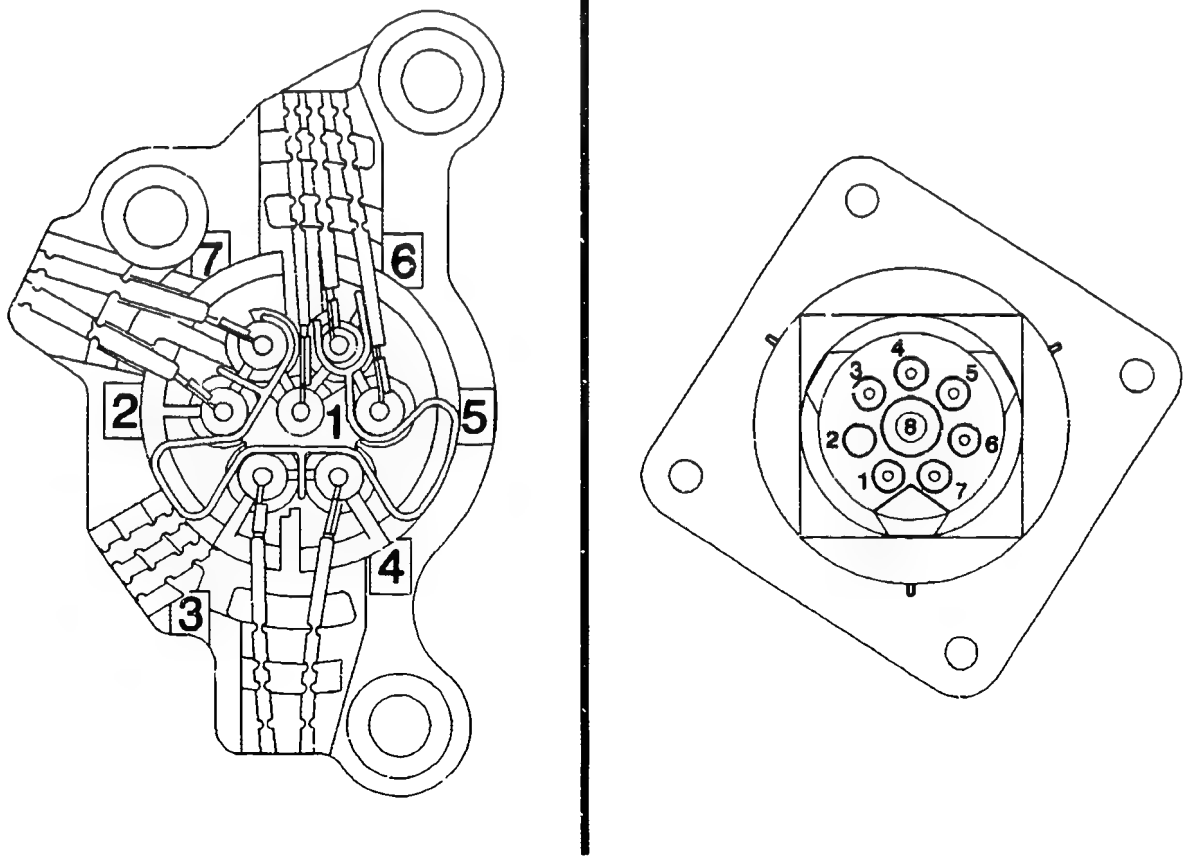
POSITIONER HOUSING - TESTING

Plug assignment for positioner version with cable bushing and overhung Schlemmer plug (e.g. MAN):

Positioner solder pin	Color	Schlemmer plug
1	green	1
2	brown	8
3	blue	3
4	white	4
5	black	5
6	red	6
7	brown	7
	not used:	2

Continue: C04/1 Fig.: C03/2

KMK04478



POSITIONER HOUSING - TESTING

If an electrical fault (open circuit, short circuit) is established or if cable bushing, lead or plug shows signs of mechanical damage, the entire cable bushing together with lead and plug is to be replaced.

Pay attention to removal and installation instructions as of
Coordinate: C05/1

Continue: C04/2

POSITIONER HOUSING - TESTING

This completes positioner testing.

If the positioner-cover tests described above necessitated correction/assembly work, attention must always be paid to the repair instructions given in the following and to which reference has already been made in the individual sections.

Were the required test results obtained without correction/assembly work?

Yes: D03/1 No: C05/1

POSITIONER HOUSING - REPAIR

Table of contents for individual repair operations:

General:	C06/1
Component fastening screws:	C07/1
Servo-magnet replacement:	C08/1
RPS replacement:	C12/1
Prestroke solenoid replacement:	C10/1
Replacing 7-pin plug connection board:	C16/1
Soldering specifications:	C23/1
Assignment of components and lead colors; laying of leads:	C28/1

Continue: C06/1

POSITIONER HOUSING - REPAIR

General:

All components in the positioner housing are available as service parts and can be replaced separately.

This involves paying attention to the repair instructions given in the following and applies not only to the assembly instructions, but also to the detailed instructions for proper soldering and arrangement of the leads at the pins of the 7-pole terminal board.

Continue: C06/2

POSITIONER HOUSING - REPAIR

General (continued):

Positioner versions with cable bushing and overhung plug:
The cable bushing is available as a complete service part, comprising terminal board with correct length of cable, crimped-on contact connector and loose plug components. The replacement of individual plugs is not envisaged, since proper and reliable crimping of the contact pins requires the use of the extremely expensive original crimping tools of the plug manufacturers.

Continue: C07/1

POSITIONER HOUSING - REPAIR

Component fastening screws:

The fastening screws for servo-magnet and 7-pin plug plate are micro-encapsulated for self-locking. The microencapsulation may already become ineffective the first time the screw is loosened (screw can be turned too easily). The procedure described in the following is thus to be employed.

Continue: C07/2

POSITIONER HOUSING - REPAIR

After removing component, use tap (M6) to clean tapped hole in positioner housing and blow out thoroughly with compressed air. There should be neither dirt nor residual oil in the holes.

Threads of screws are also to be cleaned with wire brush.

To assemble component, apply small quantity of Loctite 242 locking compound to screw threads, screw in and tighten to torque of 9...11 Nm.

Continue: C08/1

POSITIONER HOUSING - REPAIR

Servo-magnet replacement:
This requires prior loosening of the RPS and possibly also unsoldering of the RPS leads.
Refer to Coordinate: C23/1

Unscrew cover plate of 7-pin plug plate (3 screws) to provide access to pins. If fitted, pull plastic insulating cap out of plug plate.
Unsolder magnet connecting leads at pins 2 and 7.
For description of soldering procedure refer to
Coordinate: C23/1

Continue: C08/2

POSITIONER HOUSING - REPAIR

Screw out fastening screws and replace magnet complete with flange plate.
Only dry magnet cleaning (e.g. armature and bore) is permitted; cleaning fluid is never to be used.
In the case of re-usable and new servo-magnets, installation is to be preceded by liberal lubrication of the armature and bore with SAE 20W20 oil.
On installation, refer to Coordinates on:

Fastening screws: C07/1
Soldering-on of leads: C25/1
RPS removal/installation: C12/1

Continue: C09/1

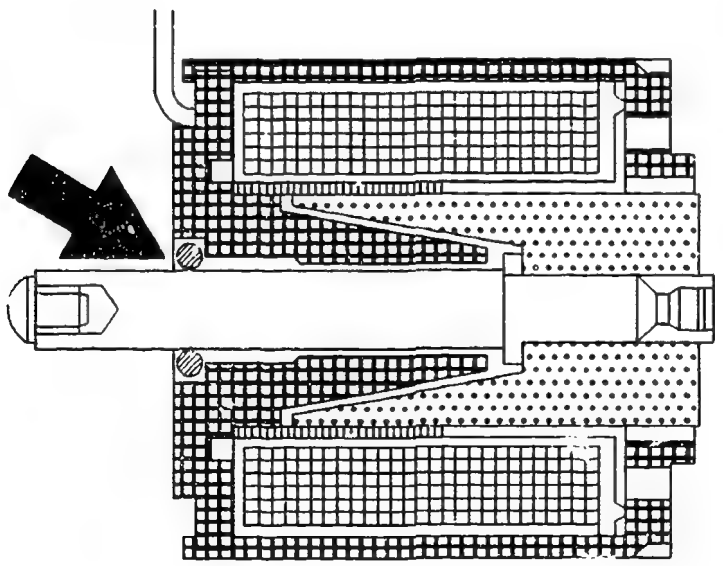
POSITIONER HOUSING - REPAIR

Note on new servo-magnets:

New servo-magnets feature an O-ring (arrow) in a groove in the area of the small bearing bore for the armature thrust pin which is designed to stop the armature dropping out.
This O-ring must be removed before fitting a new servo-magnet. The required freedom of magnet movement is not obtained with the O-ring.

Continue: C10/1 Fig.: C09/2

KMK02236



POSITIONER HOUSING - REPAIR

Prestroke solenoid replacement:

Requires prior loosening of the RPS and possibly also unsoldering of the RPS leads.

See Coordinate: C23/1

Continue: C10/2

POSITIONER HOUSING - REPAIR

Prestroke solenoid replacement:

Unscrew cover plate of 7-pin plug plate (3 screws) to provide access to pins. If fitted, pull plastic insulating cap out of plug plate. Unsolder solenoid connecting leads at pins 3 and 4. For description of soldering procedure refer to Coordinate: C23/1

Continue: C11/1

POSITIONER HOUSING - REPAIR

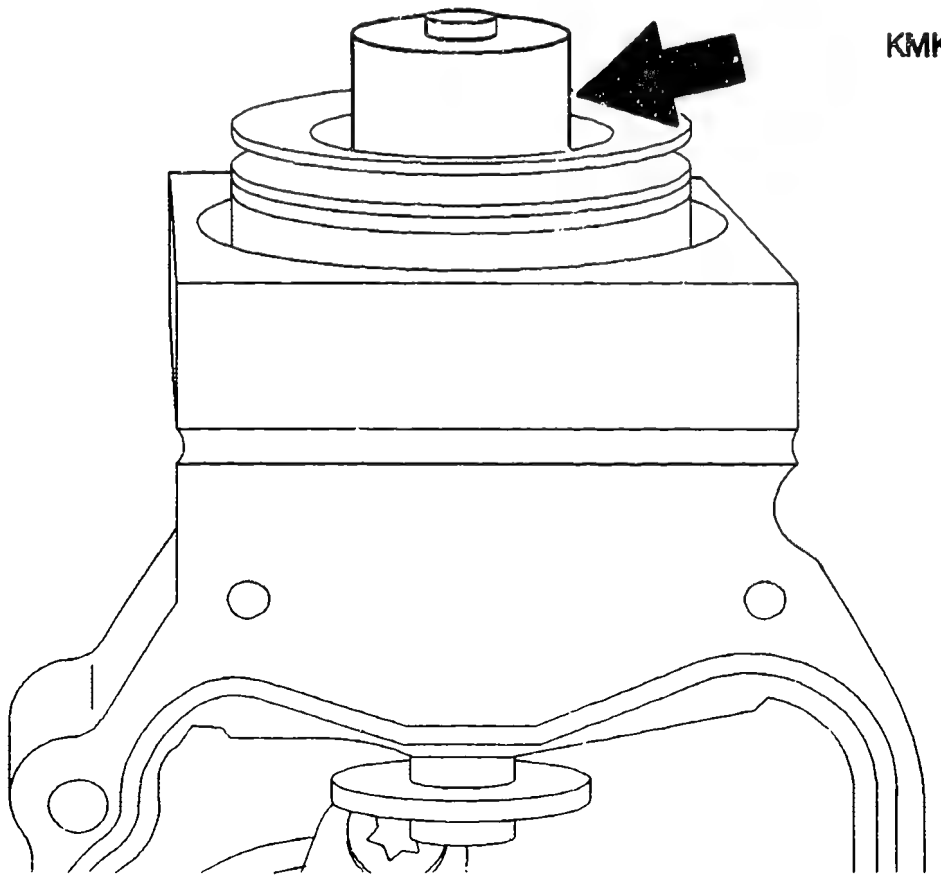
Loosen and screw out the 4 fastening screws of the solenoid cover. Remove cup springs, washer and prestroke solenoid from positioner housing.

Before installing new prestroke solenoid, liberally lubricate visible area (arrow) of armature with SAE 20W20 oil.

Pay attention on installation to Coordinates on:

Soldering-on of leads: C25/1

Continue: C12/1 Fig.: C11/2

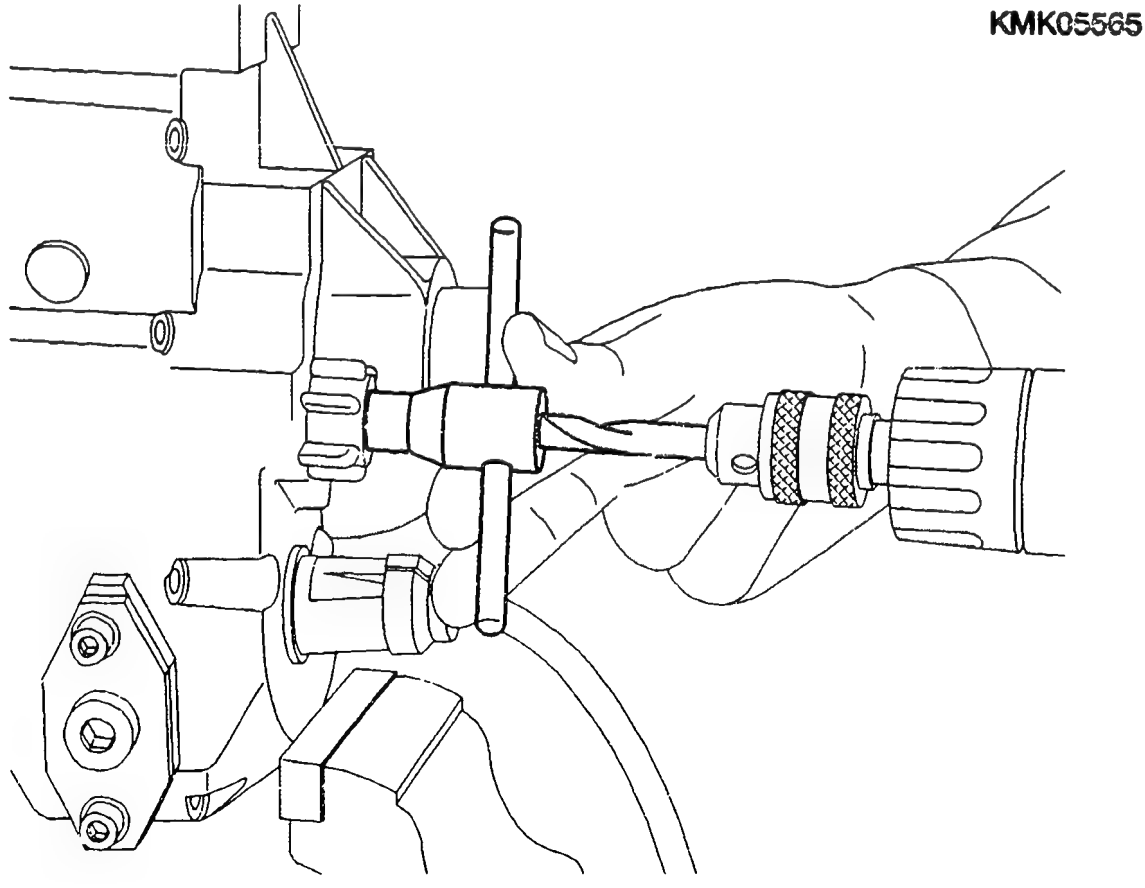


POSITIONER HOUSING - REPAIR

RPS removal - outer plastic seal in positioner housing

Seal can only be drilled out and destroyed in the process using 12 mm drill. When doing so, secure seal with pin-type socket wrench 0 986 611 459 (KDEP 2990) to prevent it turning and drill it out until it is pierced (retainers break off). Attention: Drill at low speed and only exerting slight force. Following penetration, pull drill back immediately to stop tip catching, as this would damage the RPS.

Continue: C13/1 Fig.: C12/2



POSITIONER HOUSING - REPAIR

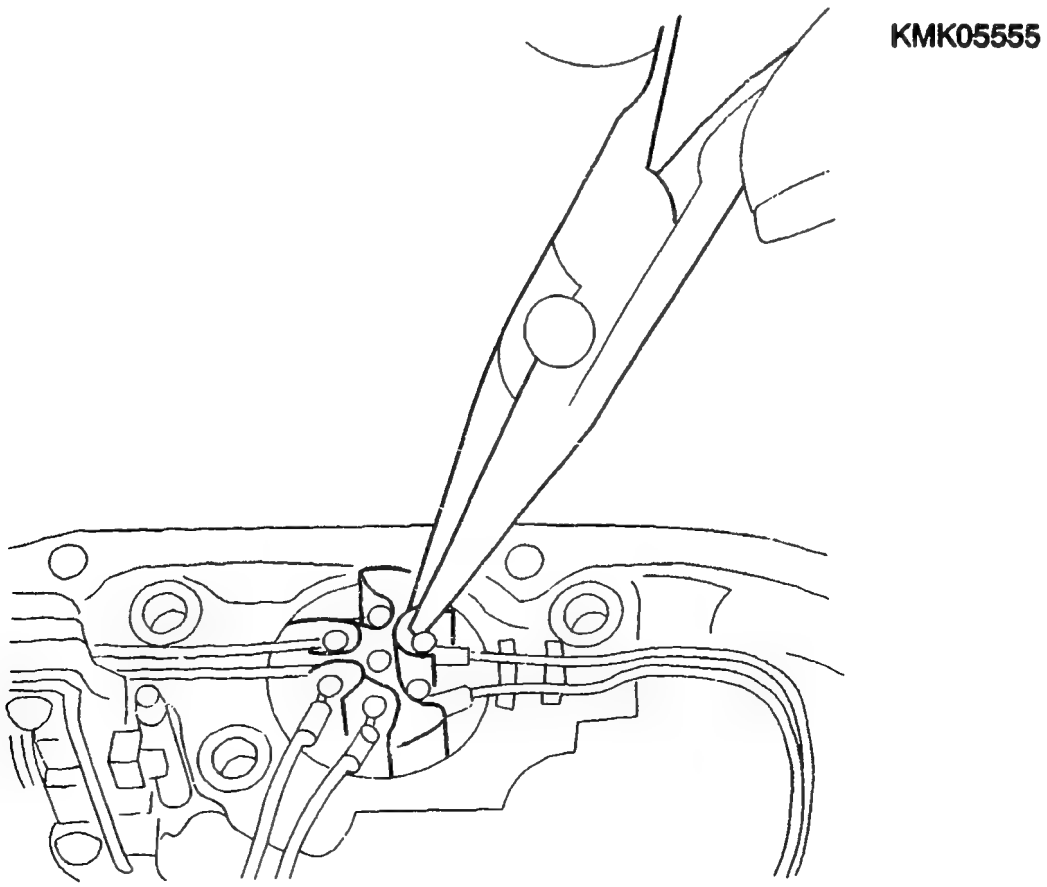
RPS removal:

Unscrew cover plate of 7-pin plug plate (3 screws) to provide access to pins. Pull plastic insulating cap out of plug plate.

Unsolder connecting leads at pins 1, 5 and 6.

For description of soldering process refer to Coordinate: C23/1

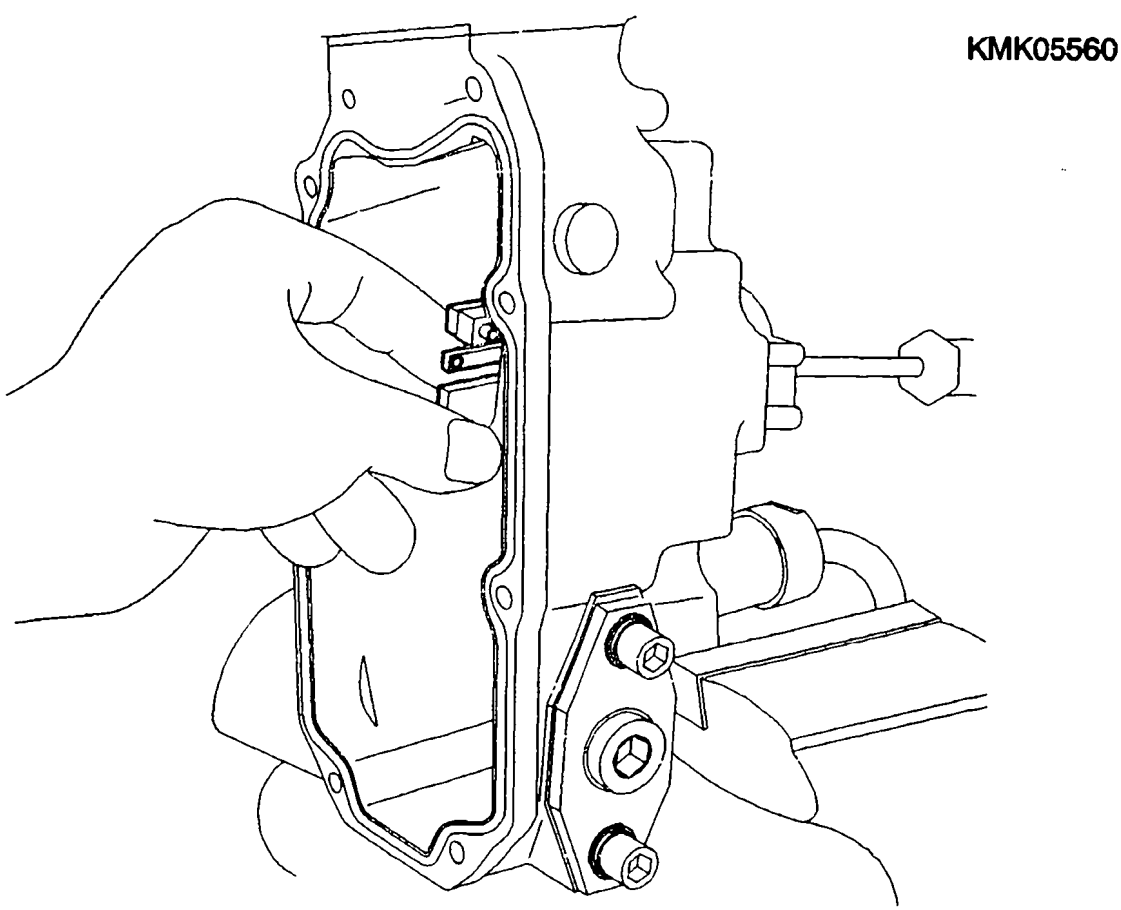
Continue: C14/1 Fig.: C13/2



POSITIONER HOUSING - REPAIR

Loosen RPS clamping screw (5 mm hexagon socket) and pull RPS out of mounting hole.

Continue: C15/1 Fig.: C14/2



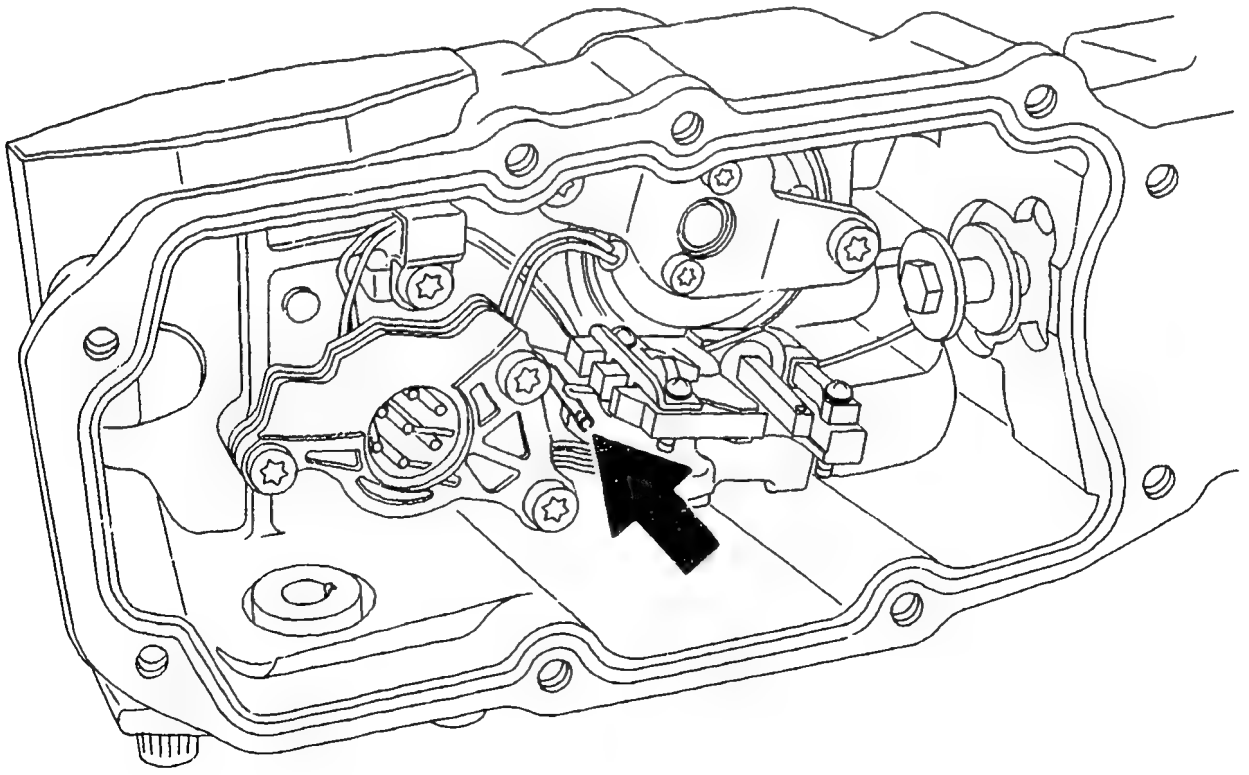
POSITIONER HOUSING - REPAIR

Note on new RPS:
Tapered clamping screw is greased with molycote. Make sure that periphery of clamping stem is free from grease. Do not screw in clamping screw with sensor removed, as this would over-extend the clamping stem.

Insert RPS as far as it will go, pay attention to guidance in guide pin (arrow) and slightly tighten clamping screw.
For soldering-on and laying of leads refer to Coordinate: C25/1

Continue: C16/1 Fig.: C15/2

KMK05559



POSITIONER HOUSING - REPAIR

Replacing 7-pin terminal board:

The following instructions apply both to positioners with housing-fixed round screw connection and to versions with cable bushing and overhung plug. Interior design, hole pattern and position of solder pins are the same for all boards.

Continue: C16/2

POSITIONER HOUSING - REPAIR

Terminal boards with cable bushing are only available as a complete service part comprising board with correct length of cable, crimped-on contact connector and loose plug components. The replacement of individual plugs is not envisaged, as proper and reliable crimping of the contacts is only possible using the extremely expensive original crimping tools of the plug manufacturers.

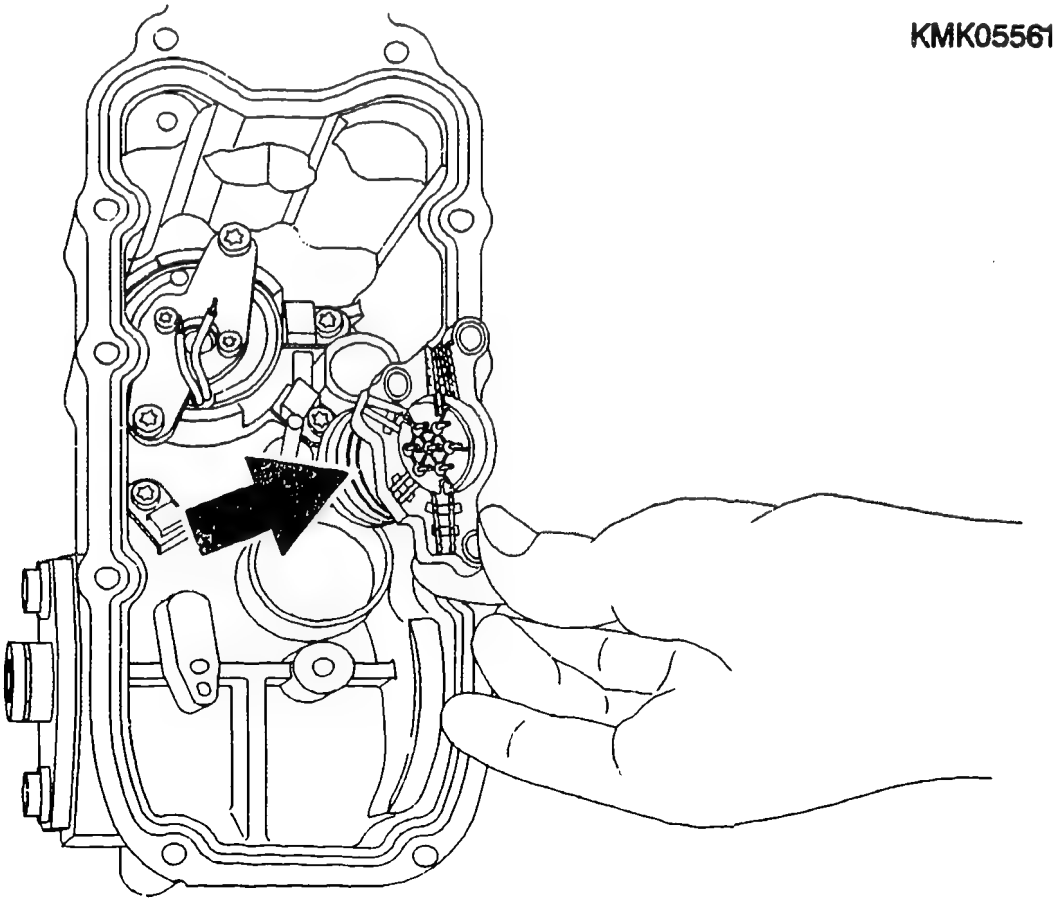
Continue: C17/1

POSITIONER HOUSING - REPAIR

Terminal board replacement:
Unscrew inner cover plate (3 screws).
Cut off cable on version with cable bushing. Remove insulation molding and unsolder all leads. For soldering process refer to
Coordinate: C23/1

Press terminal board out of positioner.
Fit new one with new O-ring (grease) and align such that holes coincide.

Continue: C18/1 Fig.: C17/2

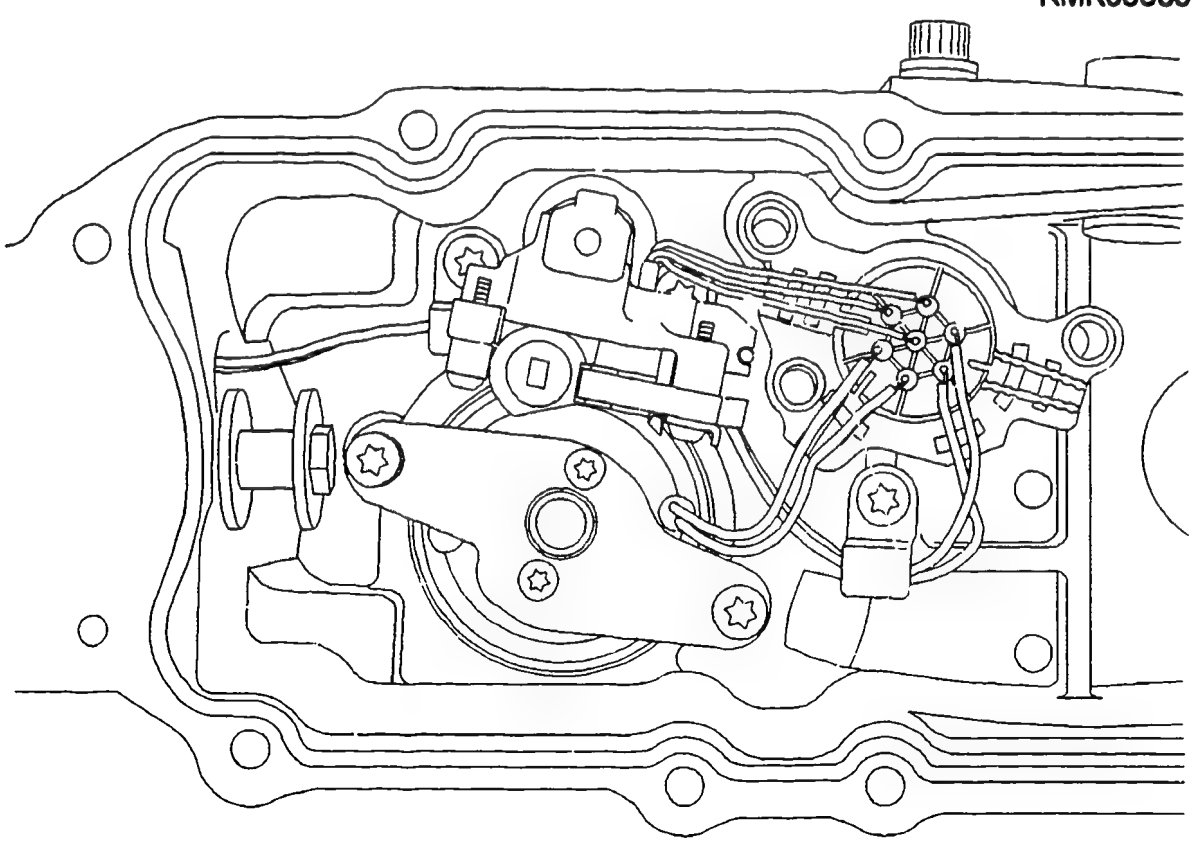


POSITIONER HOUSING - REPAIR

Solder component leads to plug pins.
For description of soldering procedure refer to
Coordinate: C25/1
Press leads into cable ducts of terminal board. Take care not to damage leads and make sure they are laid without kinks/tension (see picture).
There must be no possibility of mutual contact and contact with moving parts.
Fit plastic insulating cap even if there was not one on removal. Install cover plate, tighten screws to torque of 8...10 Nm.

Continue: C19/1 Fig.: C18/2

KMK05569



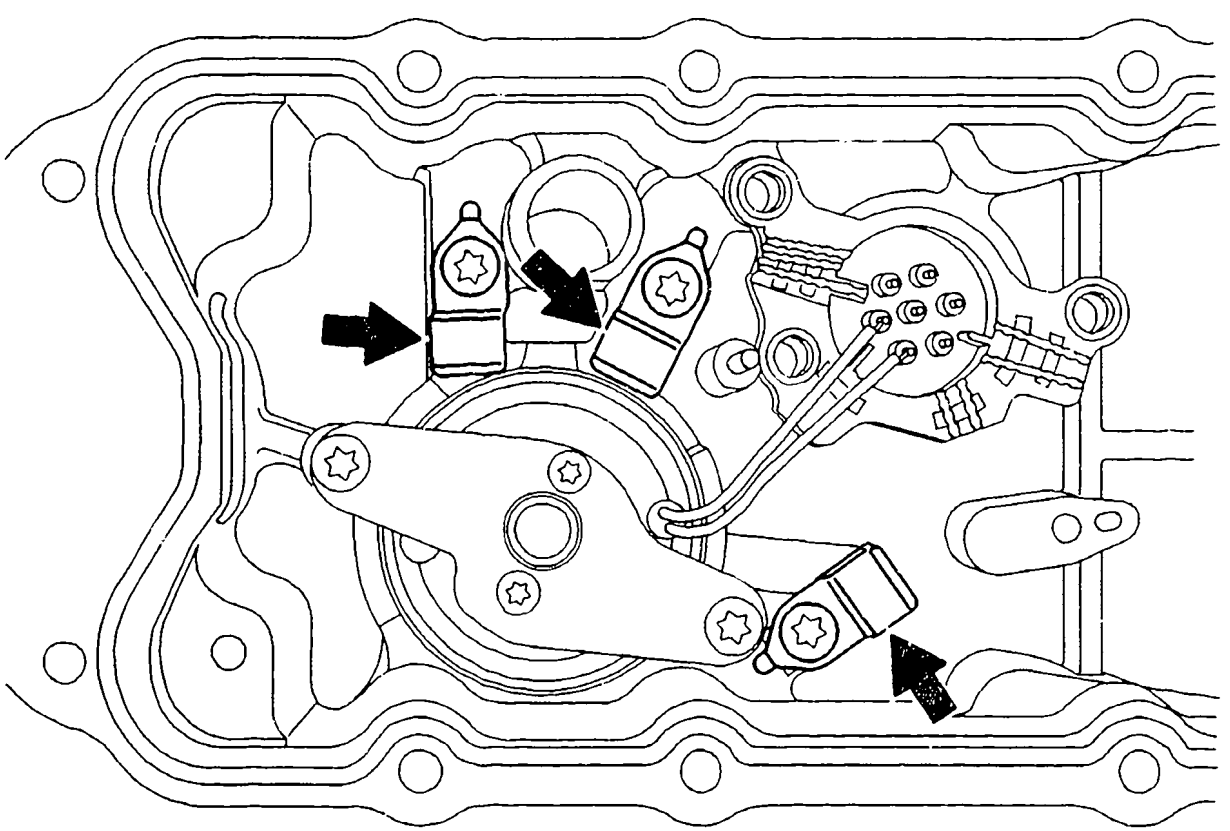
POSITIONER HOUSING - REPAIR

On account of their length, the leads of the prestroke solenoid are laid in special vibration dampers (fig. - arrows).

When laying leads, it is to be ensured that each one is properly located in the vibration dampers.

Continue: C20/1 Fig.: C19/2

KMK05564



POSITIONER HOUSING - REPAIR

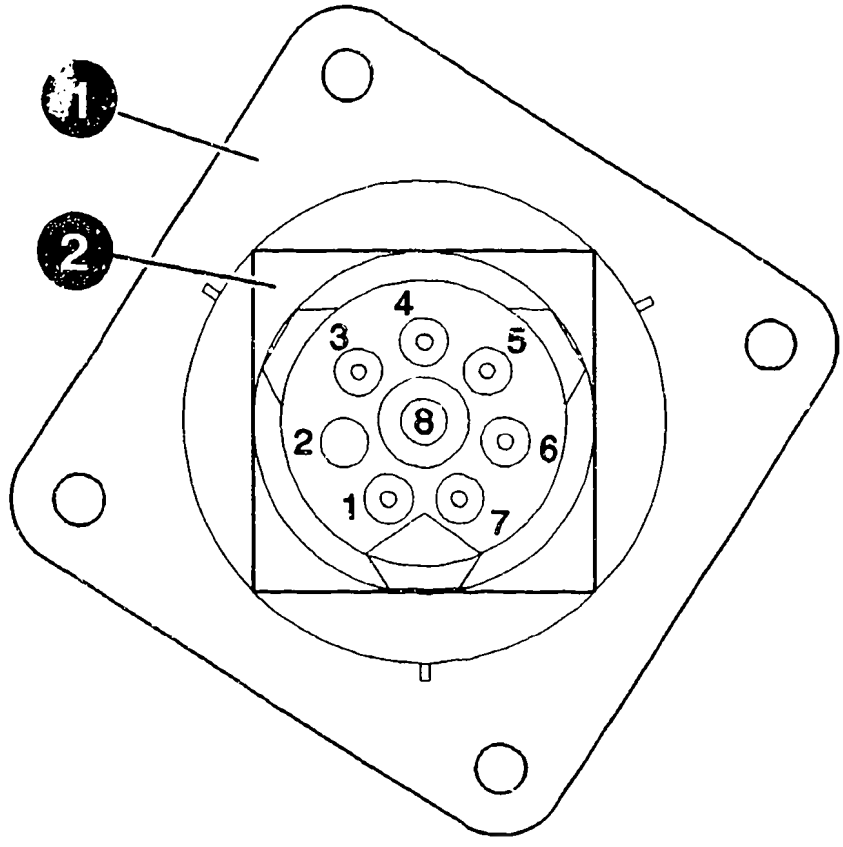
Plug installation on positioner version with cable bushing and Schlemmer plug (e.g. MAN):

Position flange plate (1) with seal on plug housing (2) and engage such that configuration of encoding and hole pattern are as shown.

Insert contact pins of individual leads into contact pin sockets in plug housing as indicated on the following Coordinate.

Continue: C21/1 Fig.: C20/2

KMK04482



POSITIONER HOUSING - REPAIR

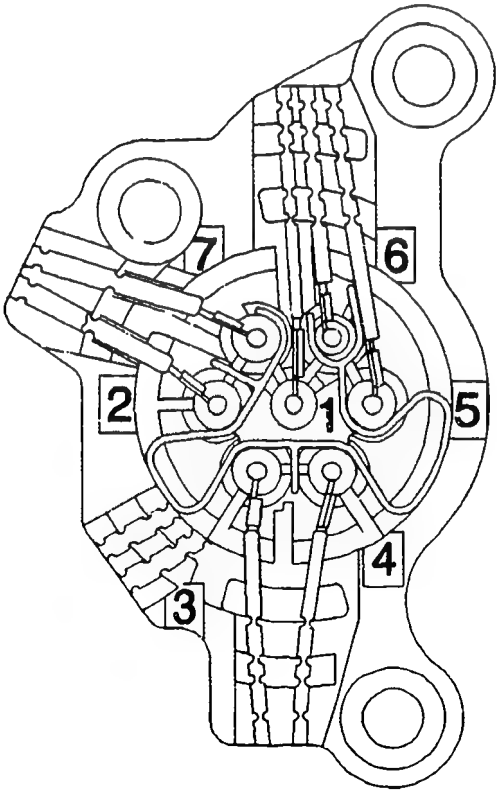
Plug assignment for Schlemmer plug and positioner terminal board:

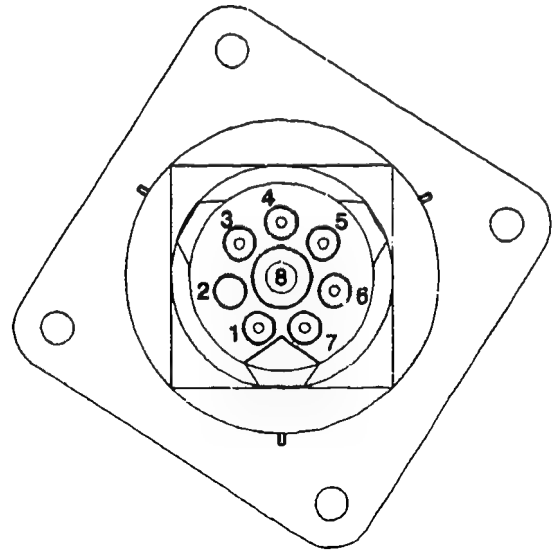
Schlemmer plug	Lead color	Positioner solder pin
1	green	1
2=not used	--	-
3	blue	3
4	white	4
5	black	5
6	red	6
7	brown (small)	7
8	brown (large)	2

Always recheck proper connection with ohmmeter.

Continue: C22/1 Fig.: C21/2

KMK04478



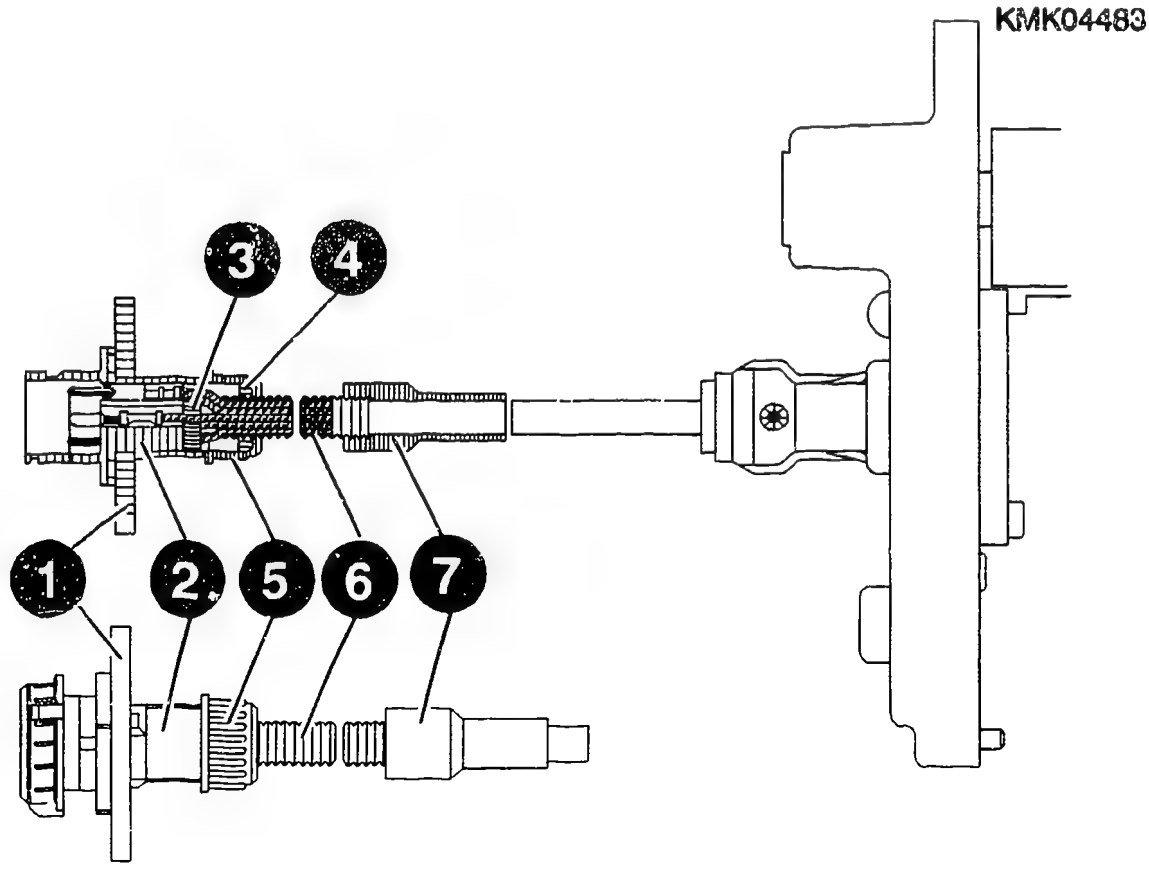


POSITIONER HOUSING - REPAIR

Attachment of Schlemmer plug:

Insert core sealing plate (3) in plug housing. Position ring seal (4) on corrugated tube (6) such that two grooves are free in front of seal. Insert corrugated tube in housing, screw on and tighten cap nut (5). Slip half length of shrink-down tubing (7) onto corrugated tube and shrink down with hot-air blower until contact is made with corrugated tube and cable.

Continue: C23/1 Fig.: C22/2



POSITIONER HOUSING - REPAIR

Soldering specification for leads on 7-pin terminal board:

Proper soldering of leads to terminal board is an essential prerequisite for correct long-term functioning of the RE positioner.
Soldering should be implemented such that contact resistance or breakage of connections caused by the considerable acceleration due to vibration at the positioner is reliably avoided.

The work described in the following is thus to be performed with extreme care.

Continue: C23/2

POSITIONER HOUSING - REPAIR

Demands made of soldering equipment:

* Temperature-regulated soldering iron
  - Soldering tip temperature 350...370 Grad C, power approx. 50 W

  Recommended:
  - Weller soldering station WTCP-S with
  - soldering iron TCP-S 24 V, 50 W
  - soldering tip no. 7, long, tapered, 370 Grad C
* Soldering tin: With no bismuth or calcium, e.g. DIN Sn60 Pb Cu2 or Sn63 Pb
* Recommended flux (solder cream): DIN F-SW 26 (2.5 %) or in USA: Type RMA 2...3 % QQ-S-571

Continue: C24/1

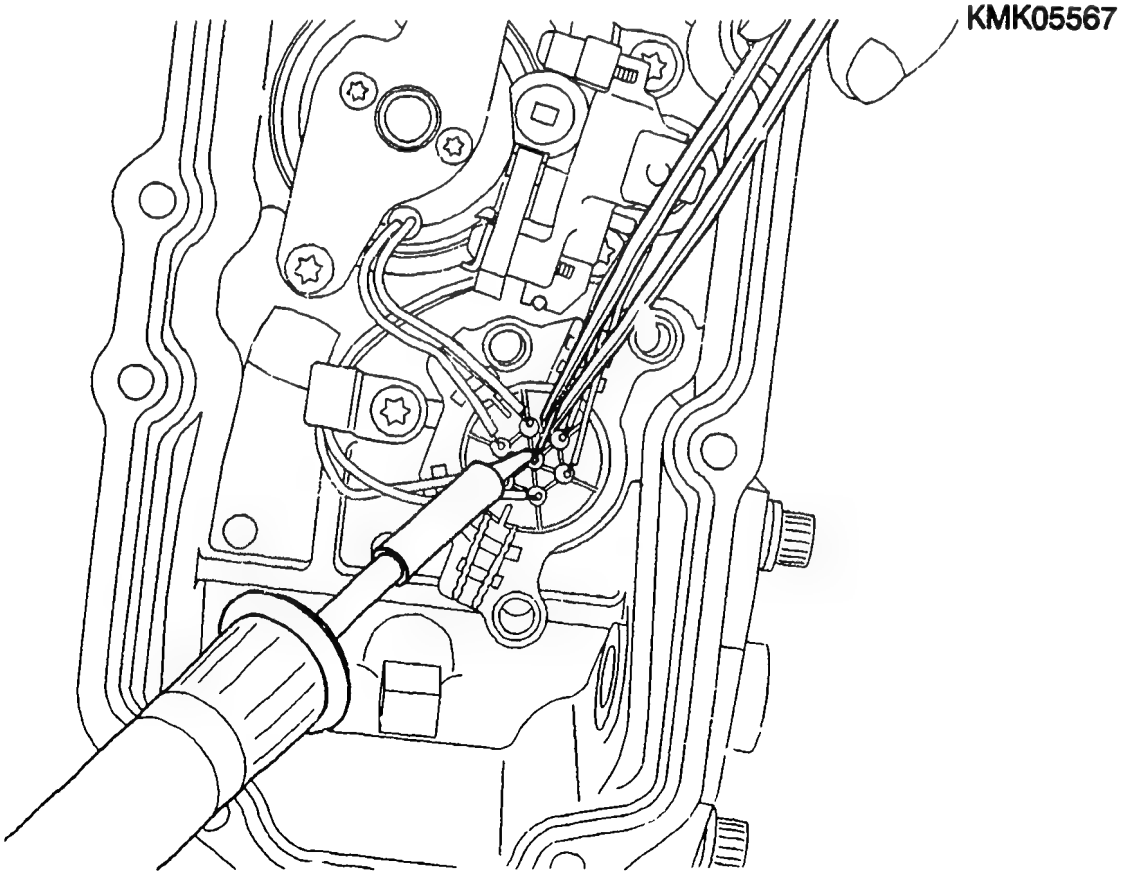
POSITIONER HOUSING - REPAIR

Soldering process:

Unscrew cover plate of 7-pin terminal board (3 screws) to provide access to contact pins. If fitted, pull plastic insulating cap out of plug plate.

Clean solder connections of component concerned (e.g. using acetone). Hold soldering iron against side of soldering eye until soldering tin is liquid and pull soldering eye off contact pin using small pointed pliers. Attention: take care not to bend contact pins (pre-damage).

Continue: C25/1 Fig.: C24/2



POSITIONER HOUSING - REPAIR

New components are supplied with correct length of lead and with crimped-on soldering eyes. Changes to the leads are not permitted.

If a new plug plate is fitted, the contact pins are to be mechanically cleaned (fine sandpaper) and with a cleaning agent (e.g. acetone) in the area to be soldered and then pre-tinned.

Continue: C26/1

POSITIONER HOUSING - REPAIR

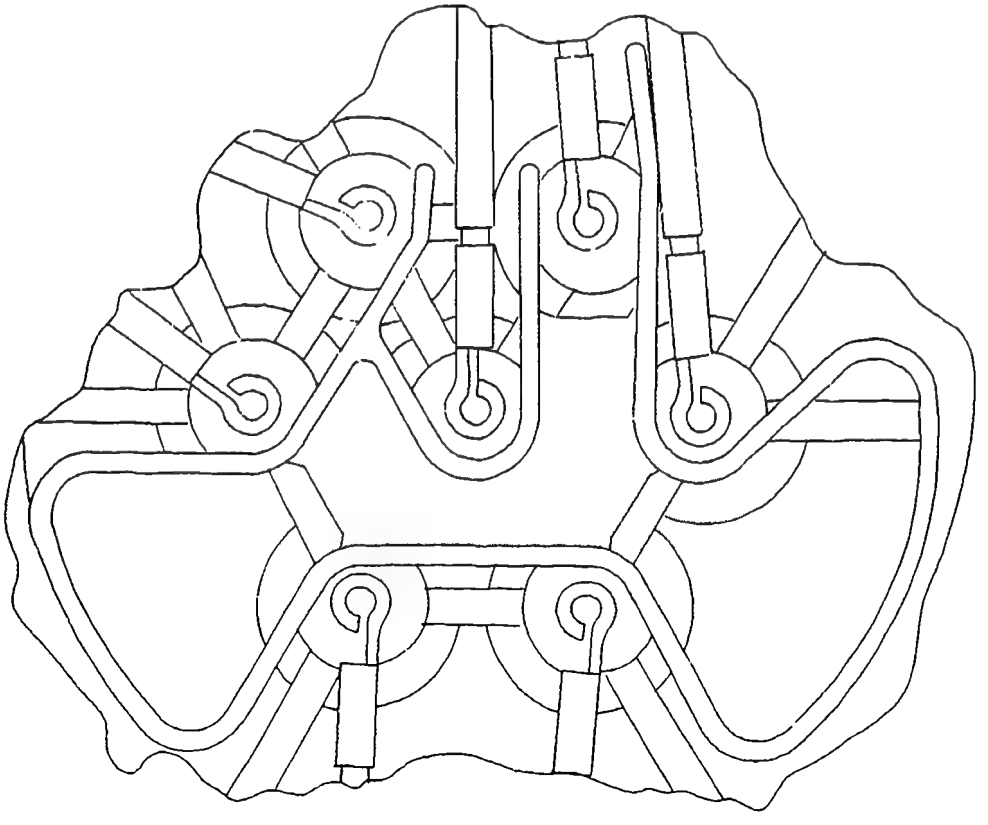
Installation position of soldering eyes:

Attach soldering eyes to contact pins such that opening in eye is always on left (as shown). Properly align eye. Eye, crimp and lead must coincide.

A small quantity of solder cream can be applied to the contact pins. Attach new eyes flush with contact pin. Heat side of eye until soldering tin is drawn in. Place re-usable soldering eyes in position, heat until soldering tin is liquid and then press down.

Continue: C27/1 Fig.: C26/2

KMK01034



REPAIRING POSITIONER COVER

Important: Do not apply too much soldering tin. There must be no soldering tin on the soldering eye in the area of the crimp, so as to maintain the flexibility of the lead.

Refer to the following Coordinate for assignment of component and lead colors to contact pins.

Continue: C28/1

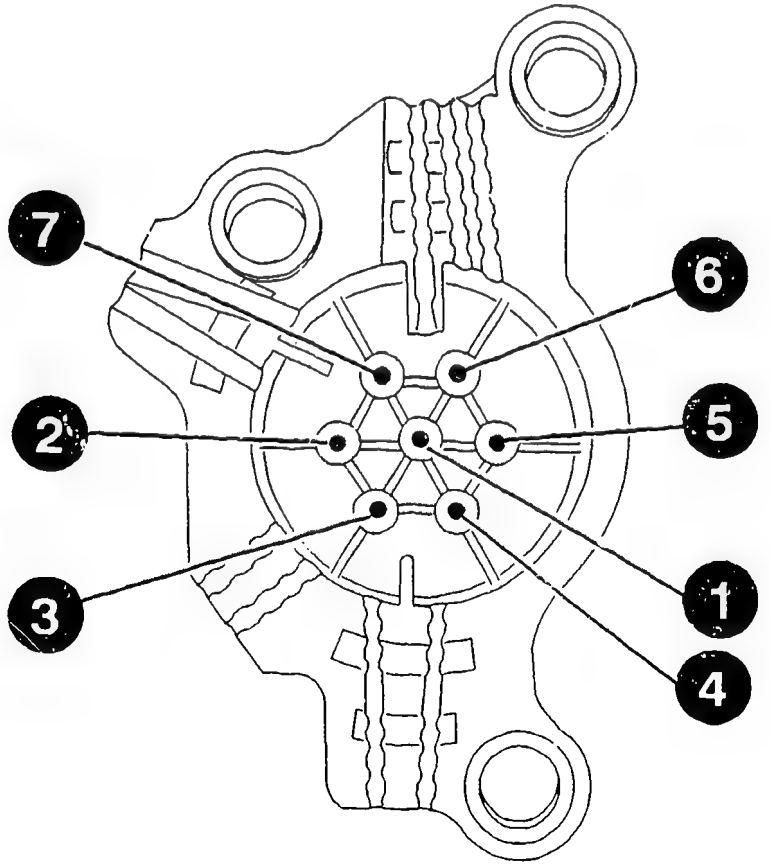
POSITIONER HOUSING - REPAIR

Assignment of components and lead colors to contact pins (fig.):
(Pin numbers are embossed on new terminal boards)

Component	Color	Contact pin
Servo-magnet	black	2
Servo-magnet	black	7
RPS	green	1
RPS	black	5
RPS	red	6
Prestroke solenoid	brown	3
Prestroke solenoid	brown	4

Continue: D01/1 Fig.: C28/2

KMK01035



POSITIONER HOUSING - REPAIR

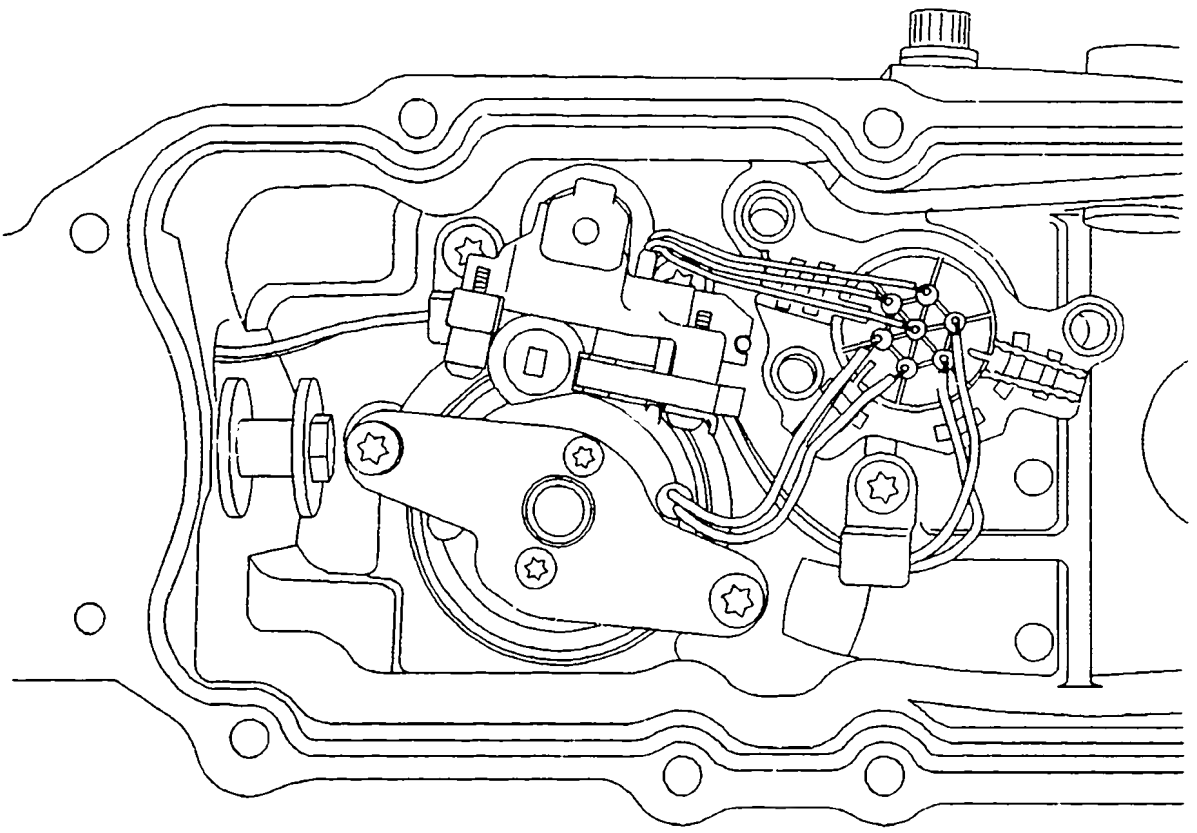
Laying of leads:

Once the leads have been soldered on they are to be inserted in the cable ducts of the terminal board.

The further routing of the leads should be as shown. It is to be ensured that the leads do not have mutual contact, that there are no kinks, that there is no stress and that they do not come into contact with moving parts.

Continue: D02/1 Fig.: D01/2

KMK05569



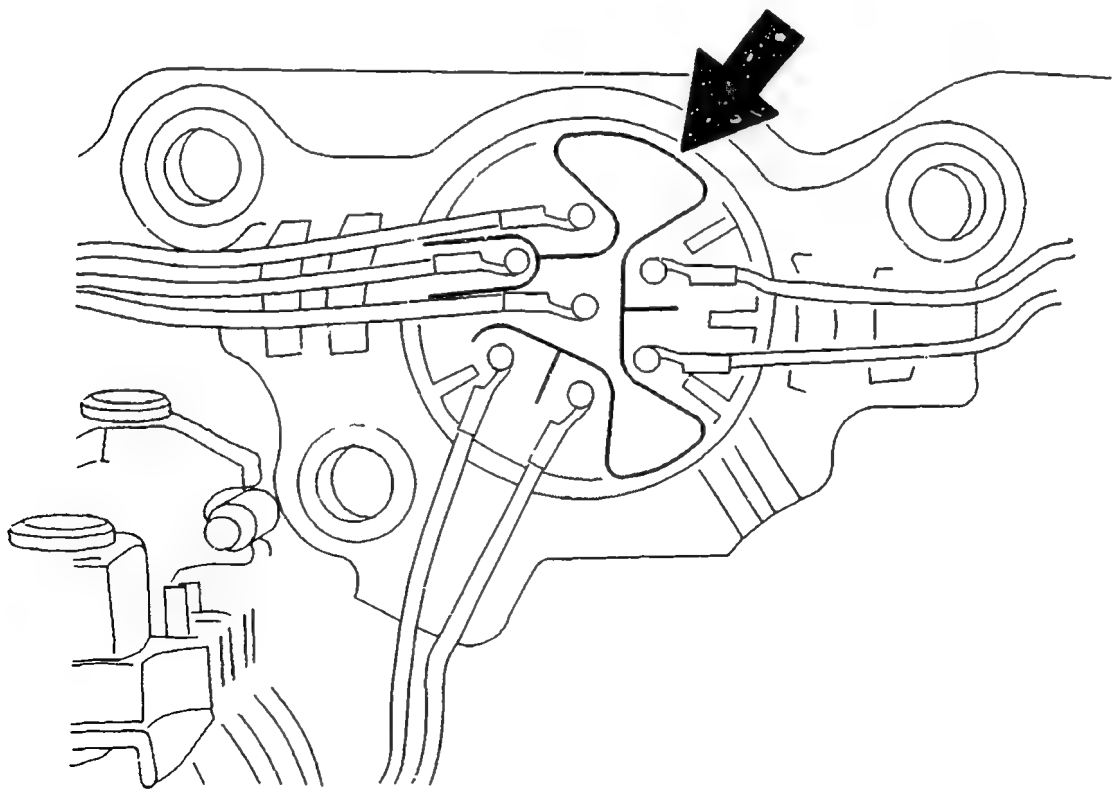
POSITIONER HOUSING - REPAIR

Plastic insulating cap (fig.):

This molding is designed such that there is a separate recess for each contact pin in the terminal board. The cap is always to be inserted in the terminal board on completion of soldering work.
The cap should likewise be retro-fitted on old positioners without this feature.
As a final step, fit cover plate and tighten fastening screws to a torque of 8...10 Nm.

Continue: D03/1 Fig.: D02/2

KMK05554

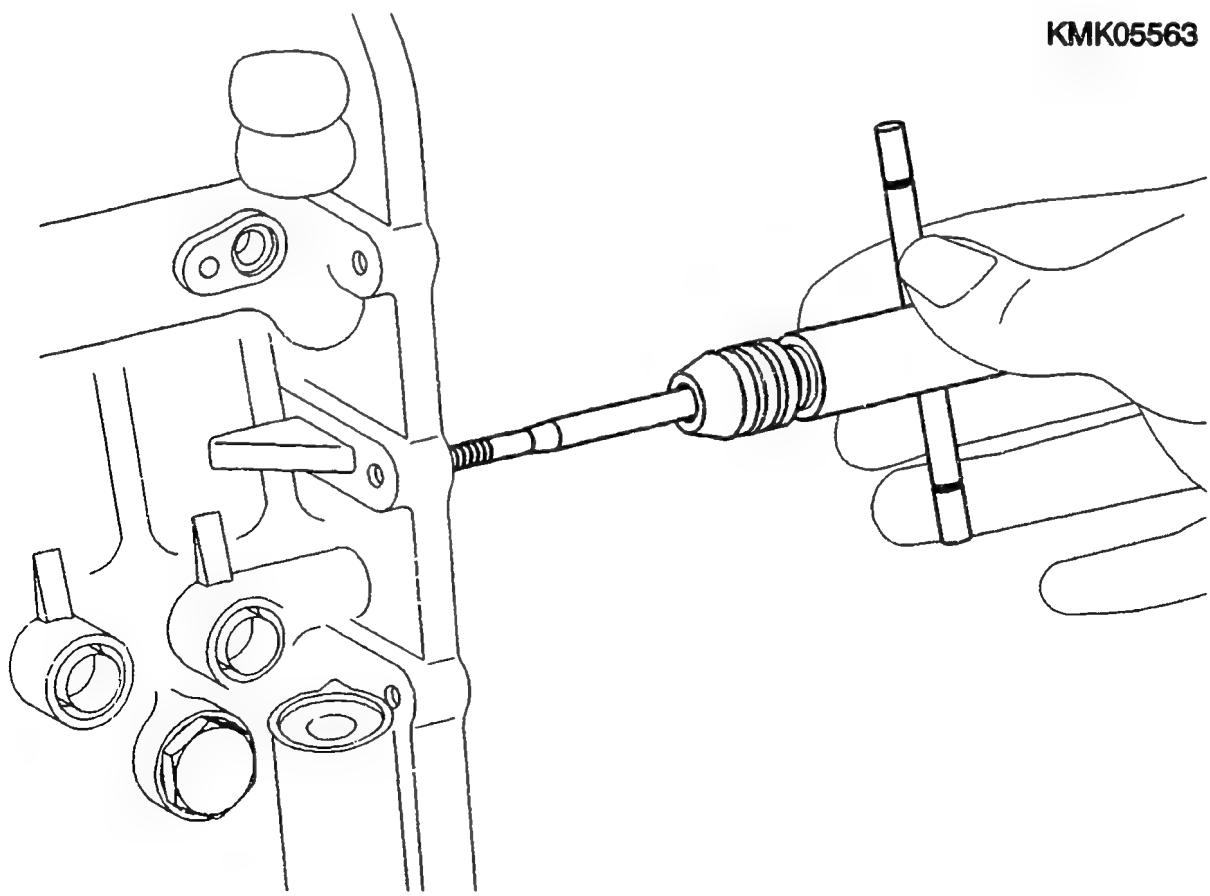


POSITIONER ASSEMBLY

Use M6 tap to clean tapped holes in pump housing and blow out with compressed air. There should be neither dirt nor residual oil in the holes.

Threads of screws are also to be cleaned with wire brush.
Note: The microencapsulation is likewise to be removed with a wire brush on new screws if they have been stored for more than 1 year. The maximum storage period for microencapsulated screws is 12 months; after this period the microencapsulation becomes too hard.

Continue: D04/1 Fig.: D03/2

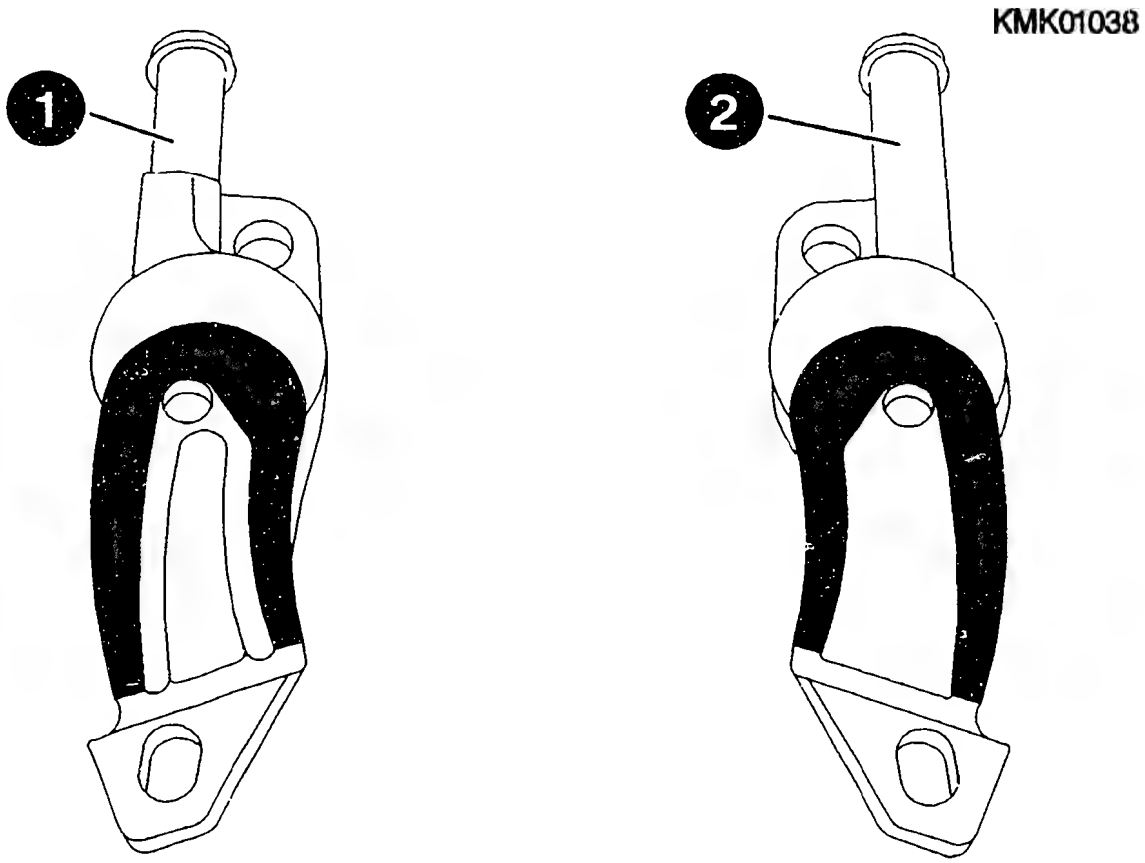


POSITIONER ASSEMBLY

Installing oil pump (viscous pump):

Note: Up until approx. mid 1994 oil pumps with different housing curvature were installed depending on the direction of rotation of the injection pump:
For counter-clockwise (fig. 1), mounted on left when viewed from disk cam side; mounted on right for clockwise (fig. 2). The corresponding oil hoses likewise differ.

Continue: D05/1 Fig.: D04/2



POSITIONER ASSEMBLY

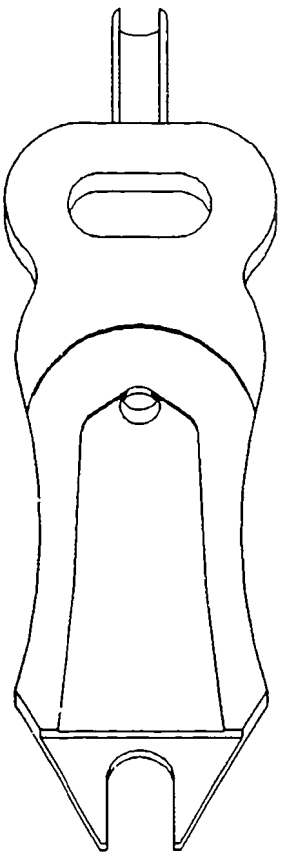
Installing oil pump (viscous pump):

As of approx. mid 1994 there is only one standard oil pump which is independent of direction of rotation. The correct installation side in line with the notes on the previous Coordinate is however still to be heeded.

The new version can also be installed in place of the direction-dependent version.

Continue: D06/1 Fig.: D05/2

KMK05292



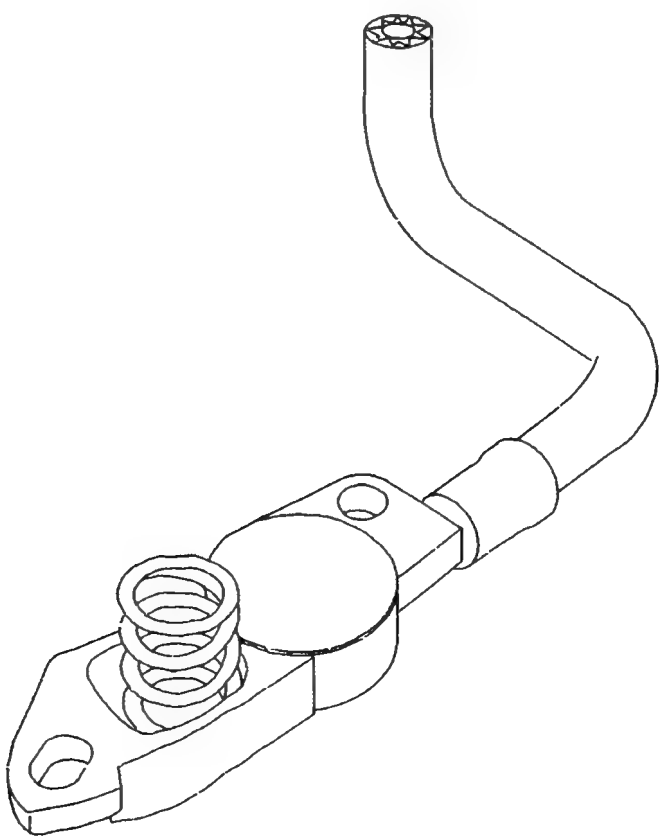
POSITIONER ASSEMBLY

Installing oil pump (viscous pump):

Note: Use cleaning agent to clean taper of camshaft, tapered hole in disk cam and fastening nut. Parts must be absolutely grease-free and dry.

Insert oil-pump spring with small quantity of hot bearing grease on back of pump.

Continue: D07/1 Fig.: D06/2



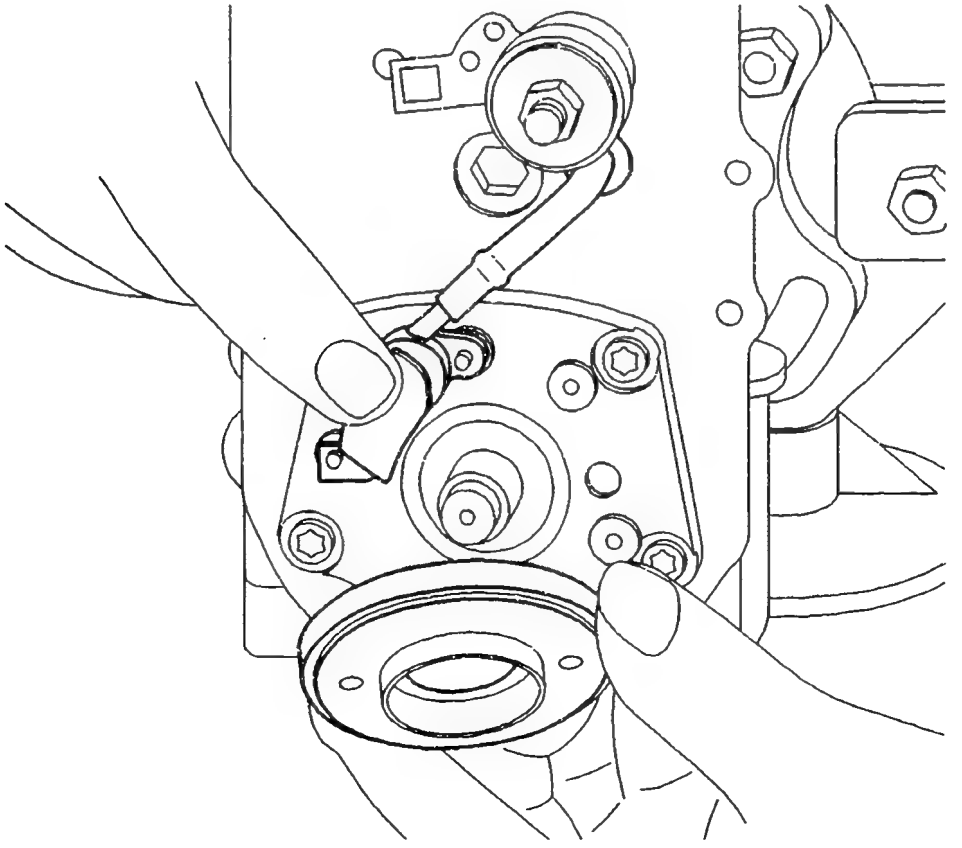
POSITIONER ASSEMBLY

Installing oil pump (viscous pump):

Place oil pump on the two guide pins in the end shield and hold. Place disk cam on taper of camshaft and hold. Screw on nut and tighten slightly. (It should be possible to turn the disk cam on the taper during subsequent adjustment).

Check whether oil pump is pressed against bearing surface of disk cam by spring force and whether it is easy to move.

Continue: D08/1 Fig.: D07/2



KMK05329

POSITIONER ASSEMBLY

Note on disk cam adjustment:

Precise fixing of the disk cam requires the use of a test bench (refer to corresponding H-pump test instructions).

Disk cam is not tightened when mounted on camshaft taper. Operating the injection pump in this condition would destroy the unit.
If the injection pump is not checked immediately after repair, it must be provided with a note to this effect.

Continue: D08/2

POSITIONER ASSEMBLY

Calibration of thrust pin in servo-magnet armature - dimension "X":

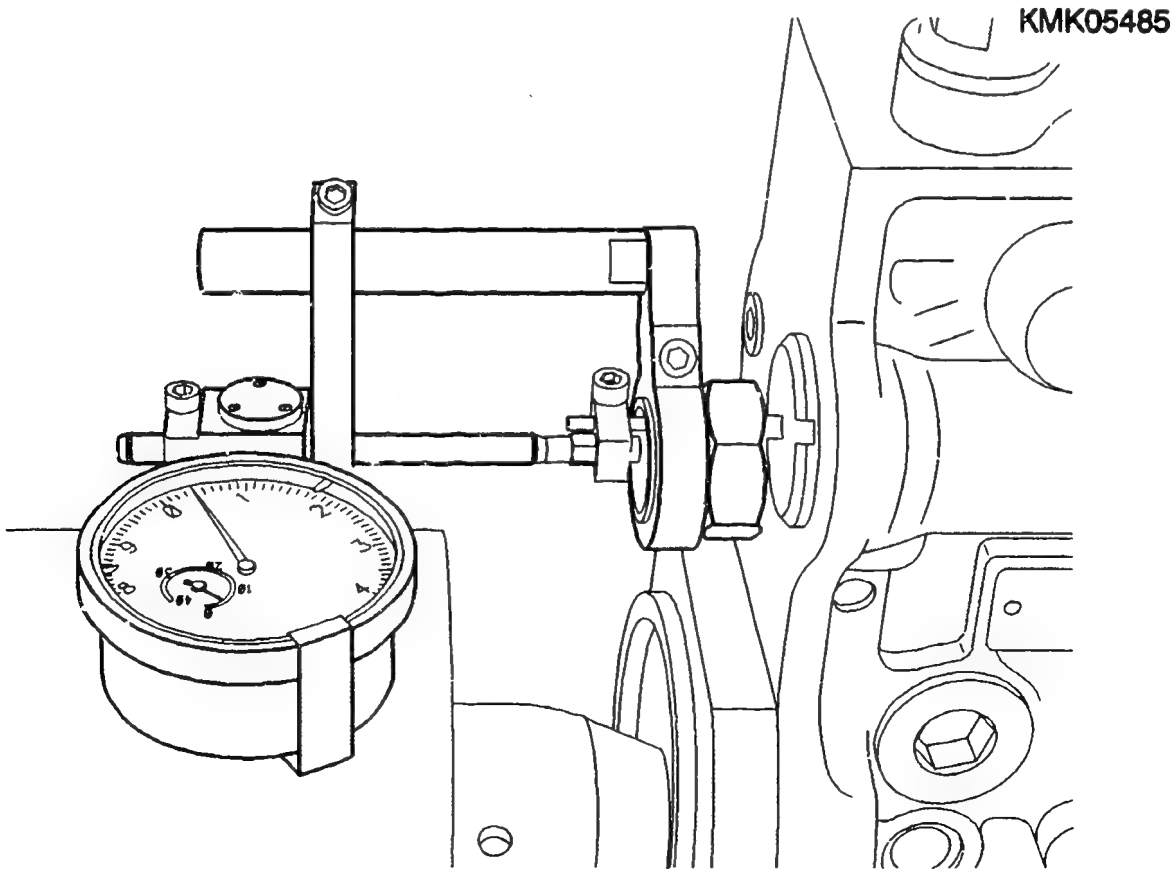
Dimension "X" = clearance between thrust pin and control rod with positioner fitted.
Set value: 0.1...0.3 mm.
Note: New positioner housings/new servo-magnets are supplied without thrust pin. The measurement method described in the following applies both to testing and possible correction with existing thrust pin as well as to new calibration with a new positioner housing/new servo-magnet.

Continue: D09/1

POSITIONER ASSEMBLY

Attach CRT measuring device
1 688 130 130 with accessory set
1 687 000 053 and threaded sleeve
1 683 315 022 (special accessory
for CRT measuring device) to pump.

Continue: D10/1 Fig.: D09/2



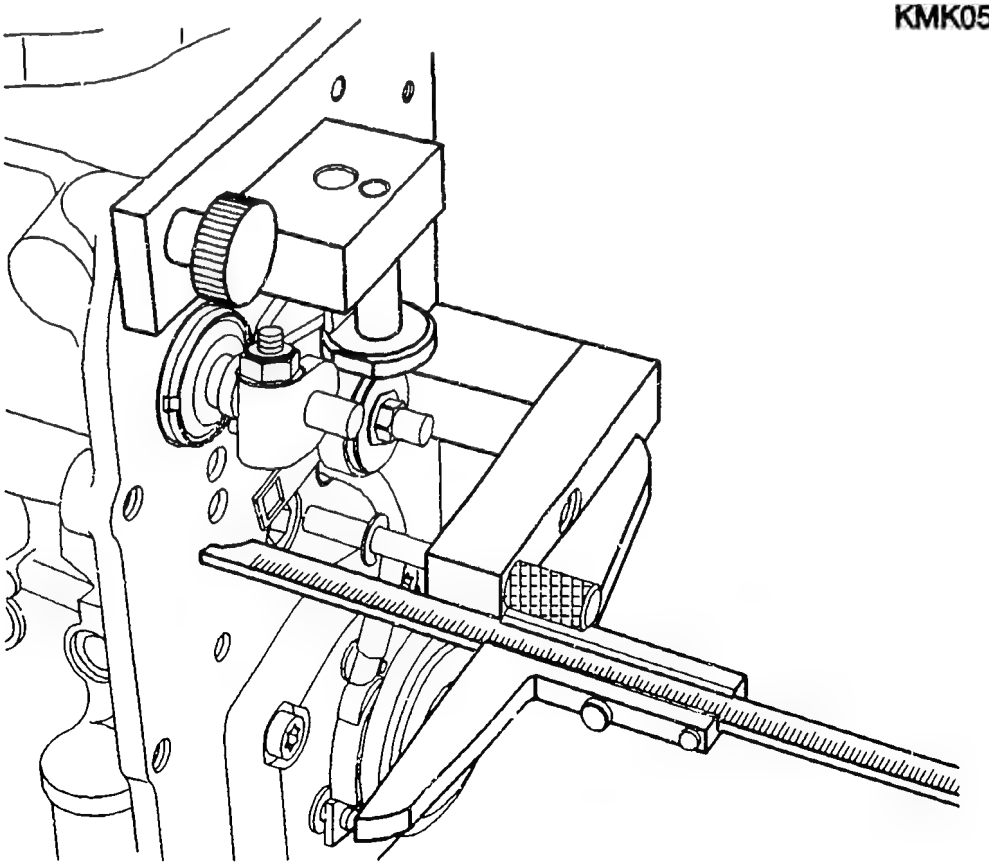
POSITIONER ASSEMBLY

Measure and determine dimension "X" as follows:

* Dimension "A" (projection of control rod over pump end face):
  Press control rod by hand as far as start control position stop and block at CRT measuring device.
  Attach adjusting device 0 986 612 620 (propeller correctly positioned) and secure with knurled screws.
  Screw out pressure screw for control rod.
  Use depth gauge to exactly measure distance between bracket of tool and pump end face - gives dimension "a 1".

Continue: D11/1 Fig.: D10/2

KMK05494



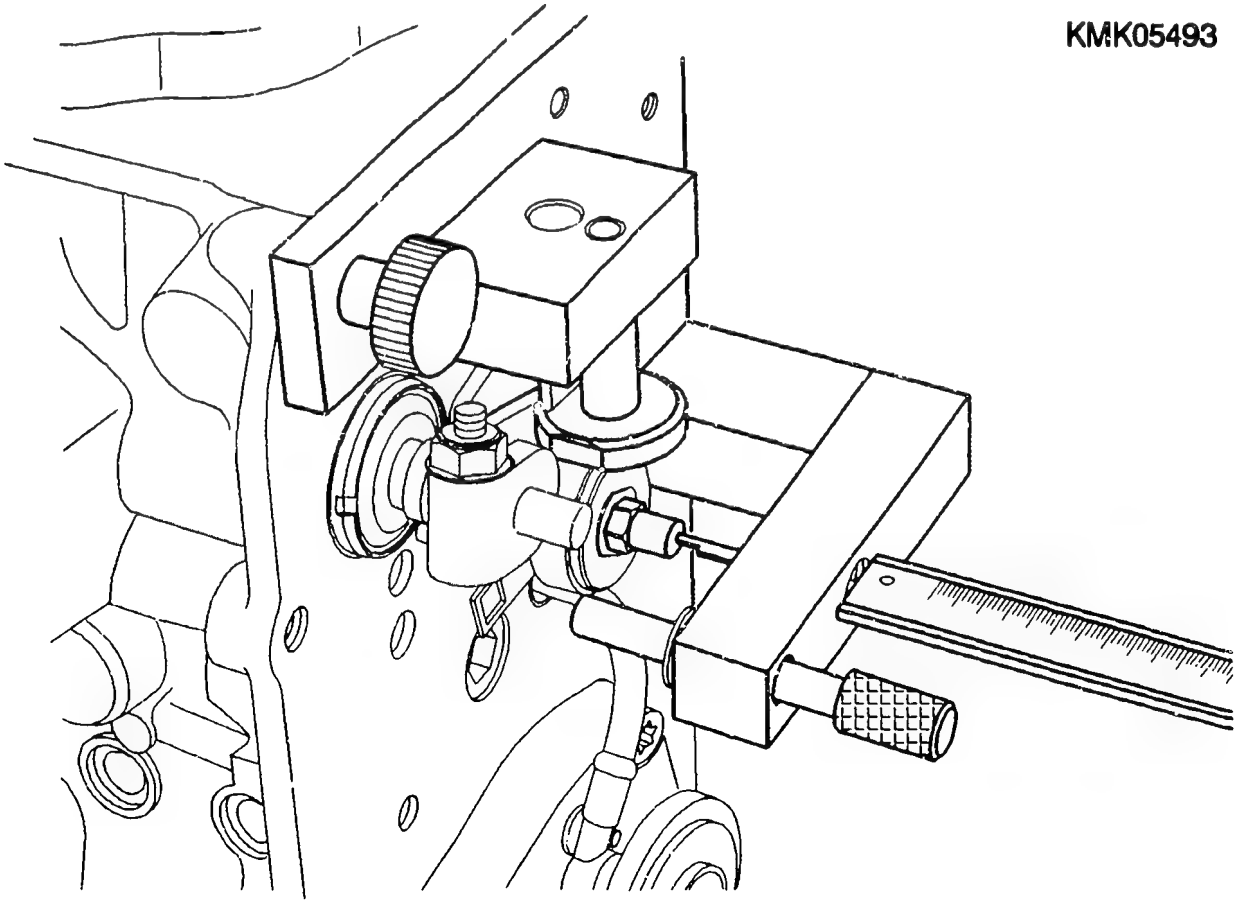
POSITIONER ASSEMBLY

* Use depth gauge to precisely measure distance between bracket and control-rod cap nut through pressure-screw hole - gives dimension "a 2".

  Calculation of dimension "A":

  "a 1" - "a 2" = dimension "A"

Continue: D12/1 Fig.: D11/2

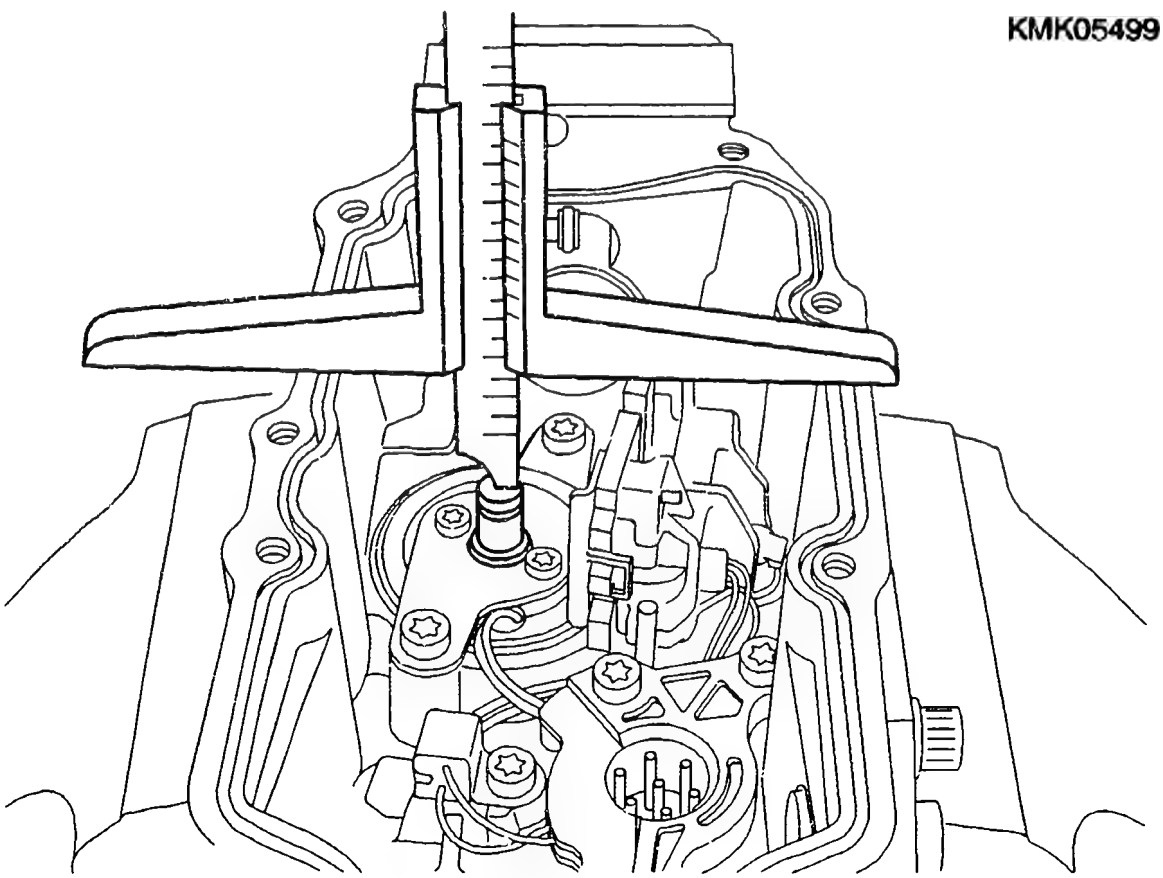


POSITIONER ASSEMBLY

* Dimension "B" - (position of armature in start position):

  Connect version-specific adapter lead 0 986 610 ... and universal test lead 0 986 610 102 to positioner.
  Set down positioner with opening facing upwards on suitable surface.
  Connect two-core leads for quantity solenoid with plug, red (+) and black (-) to regulator.

Continue: D13/1 Fig.: D12/2



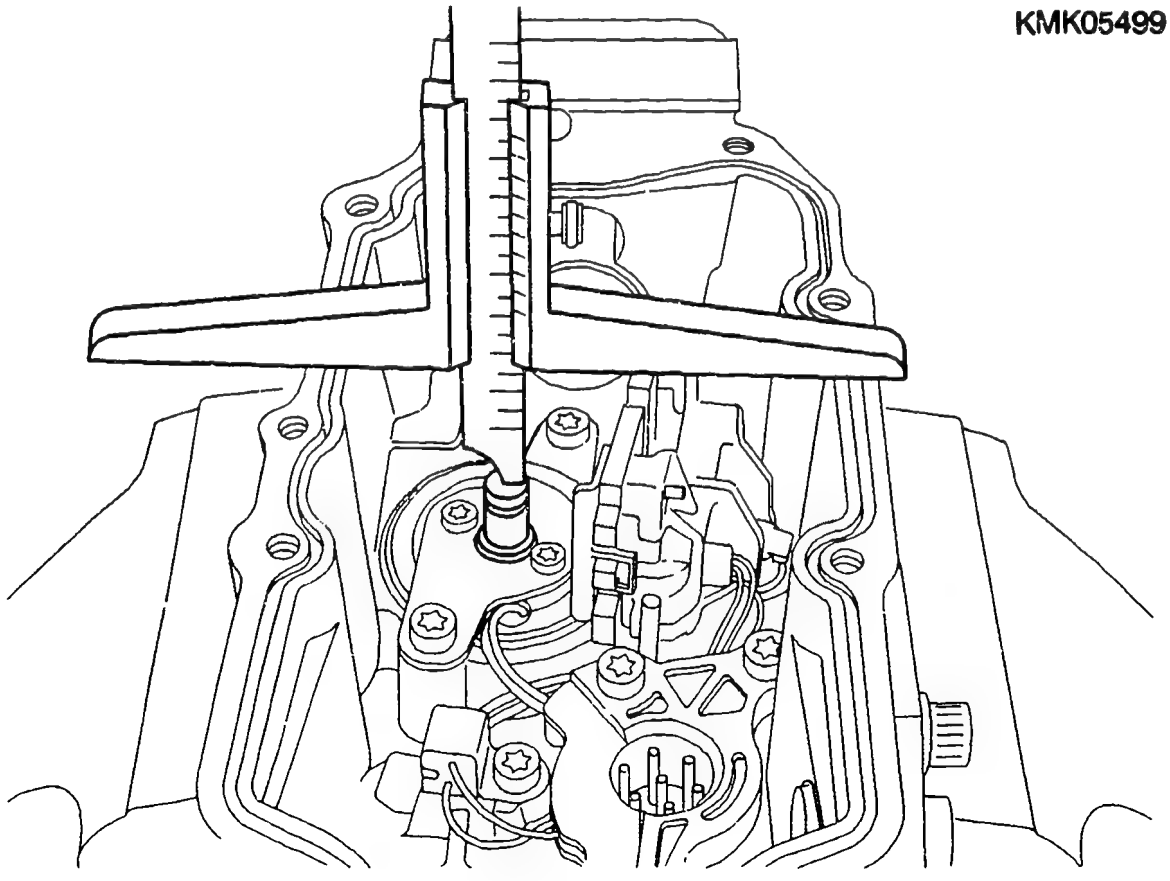
POSITIONER ASSEMBLY

* Set current such that armature extends as far as stop.
  Use depth gauge to measure distance between positioner attachment surface (without seal) and thrust pin of armature .

  Attention:
  As solenoid becomes warm, measurement is to be restricted to max. 1 minute.

  Measurement result = dimension "B".

Continue: D14/1 Fig.: D13/2



POSITIONER ASSEMBLY

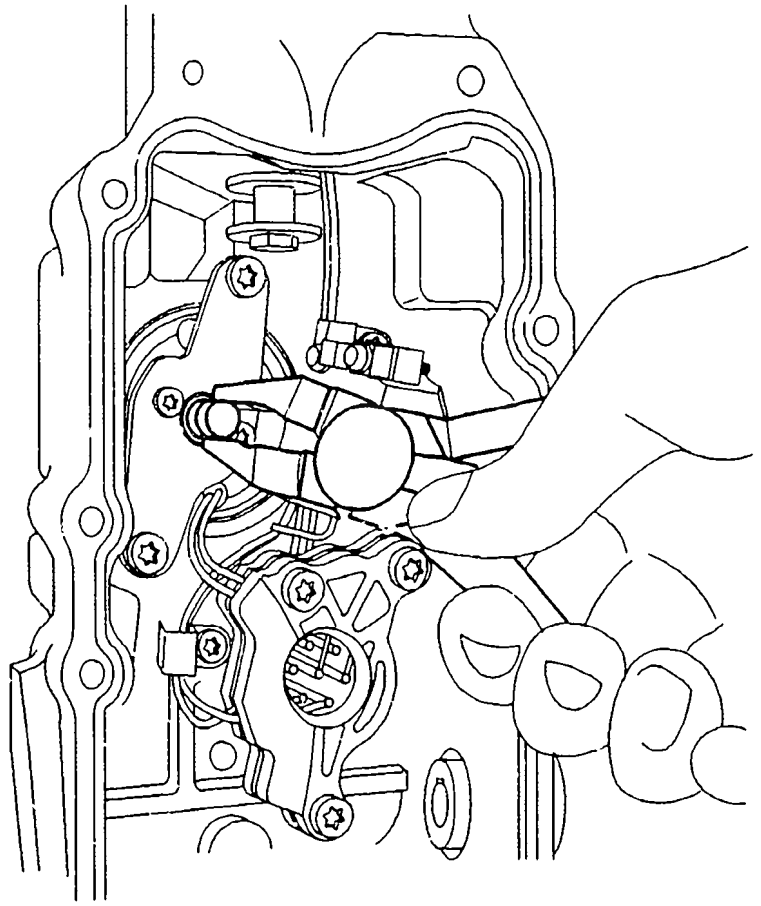
* Calculation of dimension "X":

  Dimension "B" - dimension "A" =
  dimension "X"

* Adjustment:
  Dimension X too big: fit appropriately larger thrust bolt in armature and vice versa.

  Example:
  Measured dimension "X" = 0.6 mm
  ===> insert 0.4 mm longer thrust pin
  (gives dimension "X" 0.2 mm).

Continue: D15/1 Fig.: D14/2



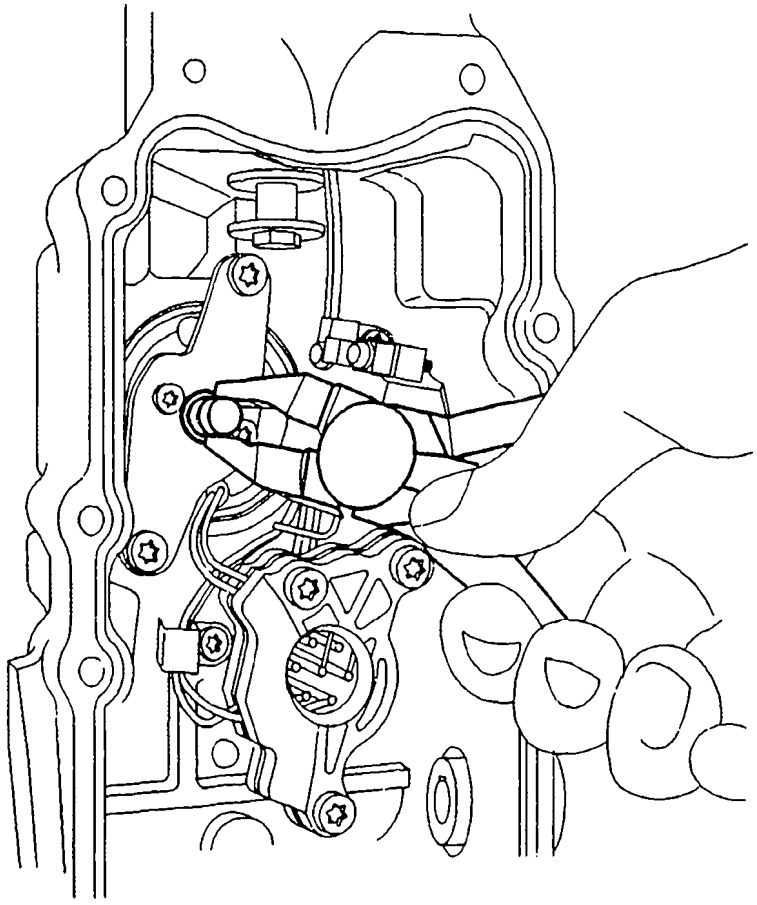
POSITIONER ASSEMBLY

Setting for new positioner:

Select new thrust pin 0.1...0.3 mm smaller than determined dimension X and press with retainer into armature as far as it will go.

Continue: D16/1 Fig.: D15/2

KMK05568



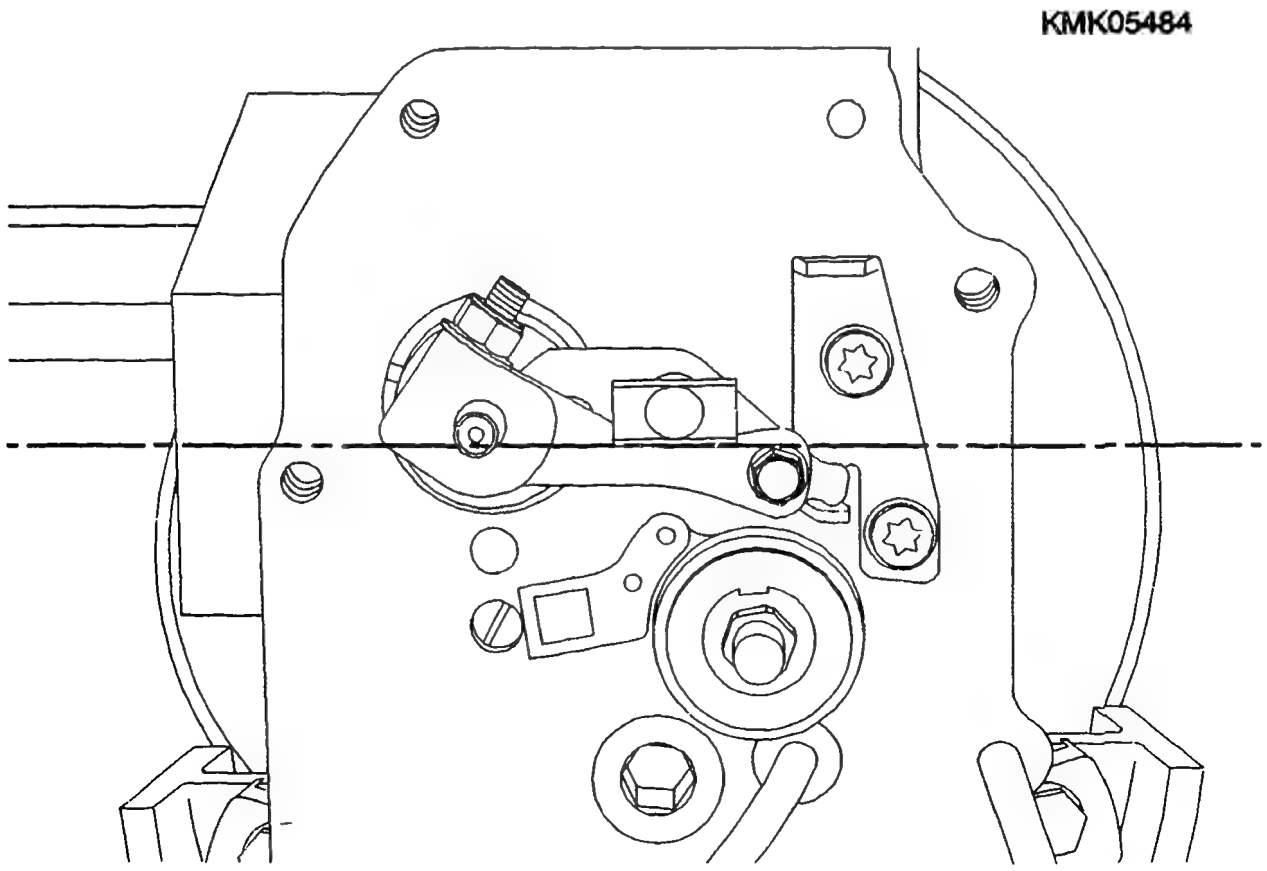
POSITIONER ASSEMBLY

Injection-pump preparation:

* Press control rod by hand into start position (as far as stop) and set CRT dial indicator to precisely 21 mm CRT.
  Make sure that dial indicator is not adjusted during subsequent installation of positioner cover.

* Prestroke shaft control lever must make contact with lower stop.
  Horizontally align (fig.) driver (propeller).

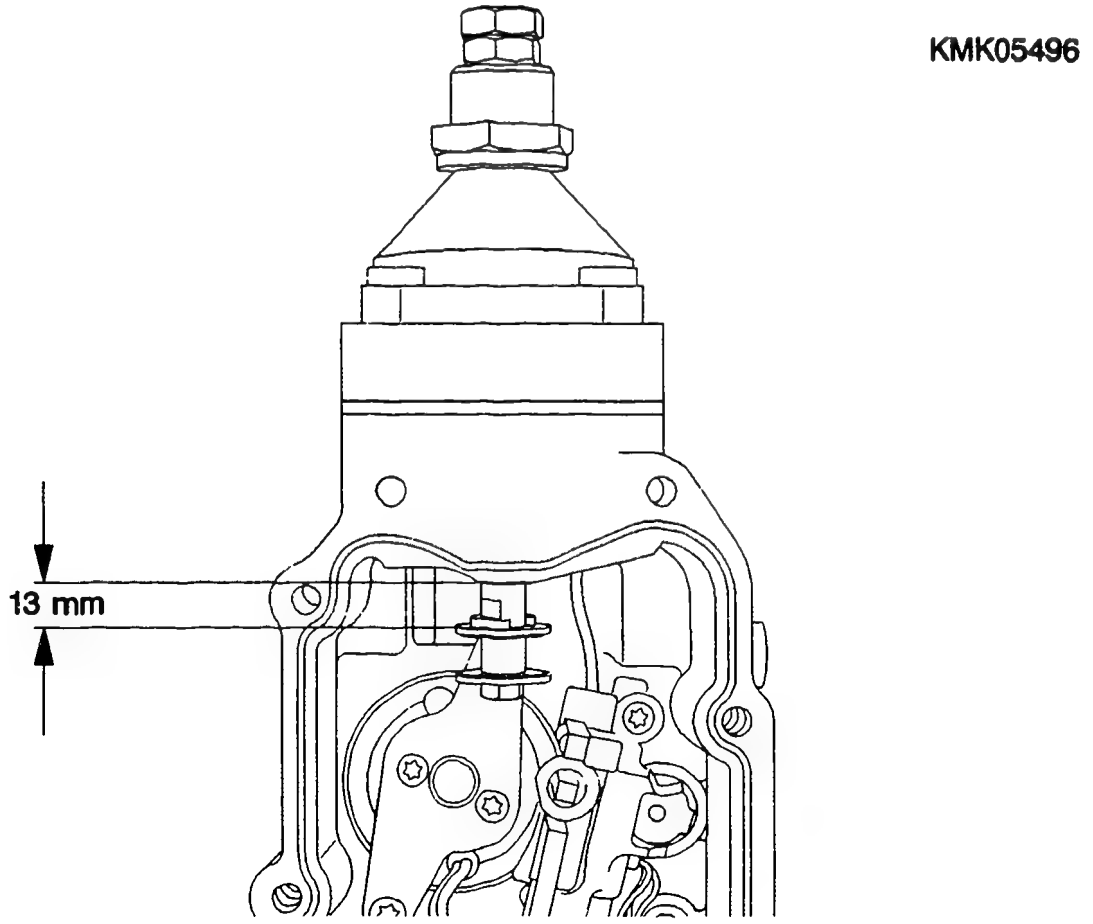
Continue: D17/1 Fig.: D16/2



POSITIONER ASSEMBLY

Unscrew housing cover over prestroke solenoid at positioner and screw on cover (tool) 0 986 612 676 in its place. Screw measuring device with adjusting screw 0 986 612 657 (without dial indicator) into tapped hole in cover.
Use adjusting screw to set armature such that distance between thread reel and housing is 13 mm (fig.).

Continue: D18/1 Fig.: D17/2



POSITIONER ASSEMBLY

Note: On positioners as of end of 1994 the housing cover over the prestroke solenoid is provided as standard with the tapped hole for the measuring device and sealed with a screw plug. Cover replacement is then not necessary.

Continue: D18/2

POSITIONER ASSEMBLY

A T T E N T I O N

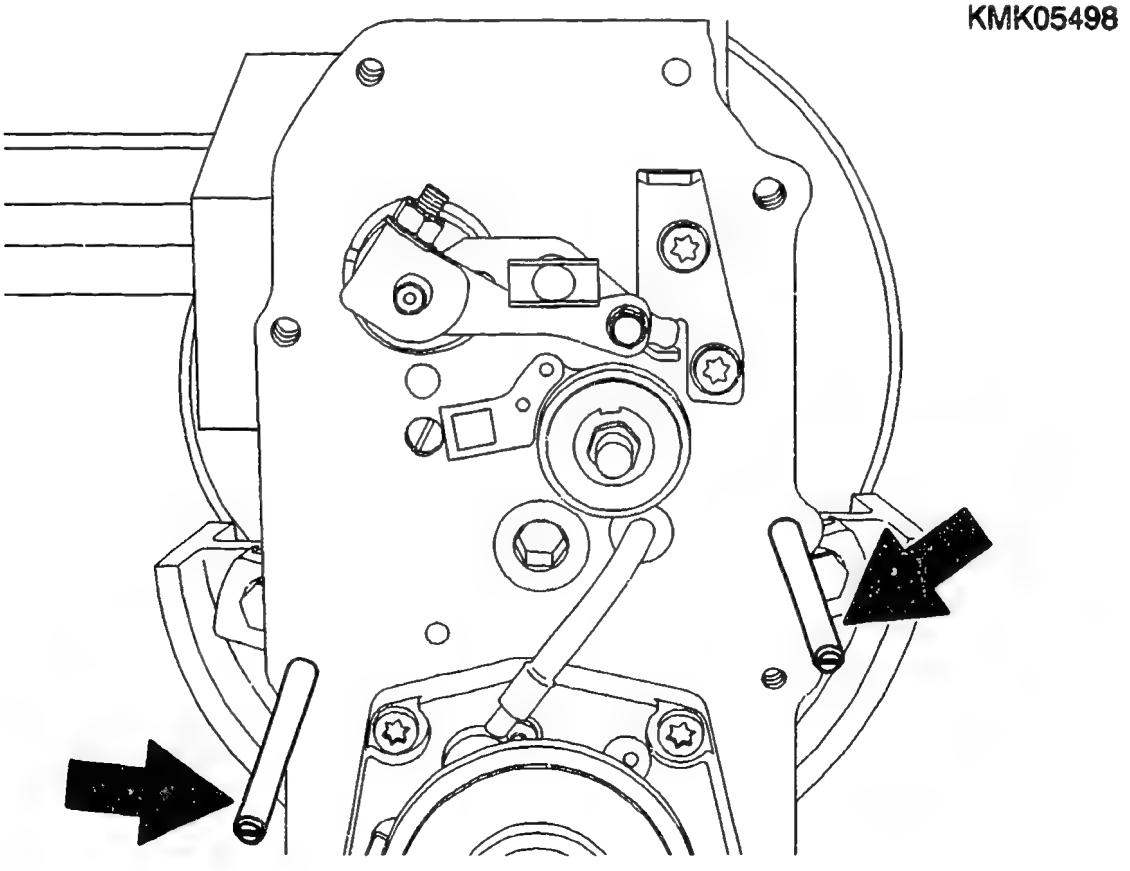
In the operation described below (mounting positioner housing on injection pump) it must be possible to slip the positioner housing without any resistance over the guide pins onto the pump. If resistance is felt, the thread reel is coming into contact with the driver (propeller) of the prestroke shaft. In such cases, slight correction is required by way of the adjusting screw of the armature (thread reel).

Continue: D19/1

POSITIONER ASSEMBLY

Attach complete positioner with new seal to pump:
Screw the two guide pins 0 986 612 598 opposite one another into two positioner fastening holes.
Fit positioner (guided by guide pin). In doing so, insert measuring arm of RPS (without contact) into short-circuiting ring and horizontal guide (without force) into drive roller of prestroke solenoid. Press on positioner and screw in screws of free holes.

Continue: D20/1 Fig.: D19/2



POSITIONER ASSEMBLY

Screw out guide bolt. Screw in remaining fastening screws and tighten to torque of 7...9 Nm.

Fit original housing cover of pre-stroke solenoid or - after removing measuring device - screw in and secure screw plug.

Continue: D21/1

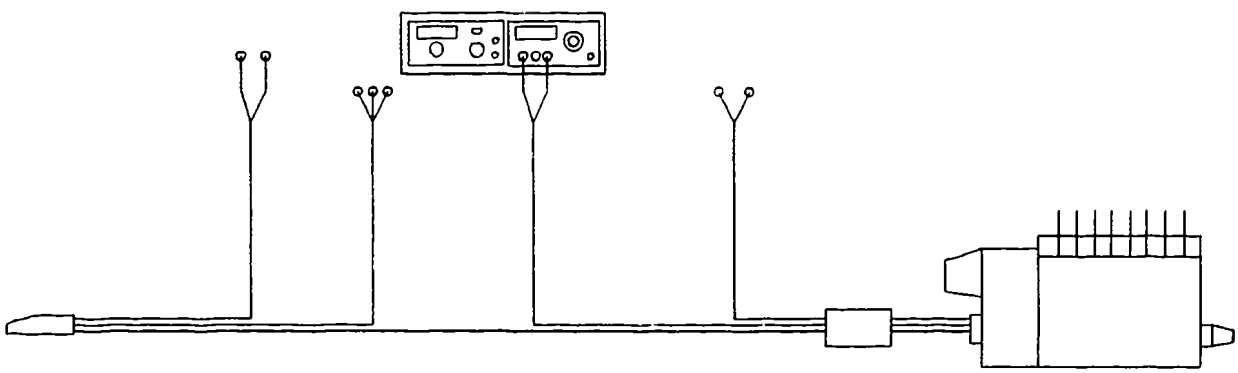
POSITIONER ASSEMBLY

Connect up universal test lead 0 986 610 102 (KDEP-P 400/2) with adapter lead suited to positioner version (see tester list) to positioner.
Connect up solenoid actuation lead for pin terminal (red plug positive, black plug negative) to regulator 12 V/15 A (adjustable).

Switch on regulator. Set current such that control rod attains maximum travel. CRT must then be 20.7...20.9 mm. Duration of this procedure max. 1 minute.

Continue: D22/1 Fig.: D21/2

KMK01057

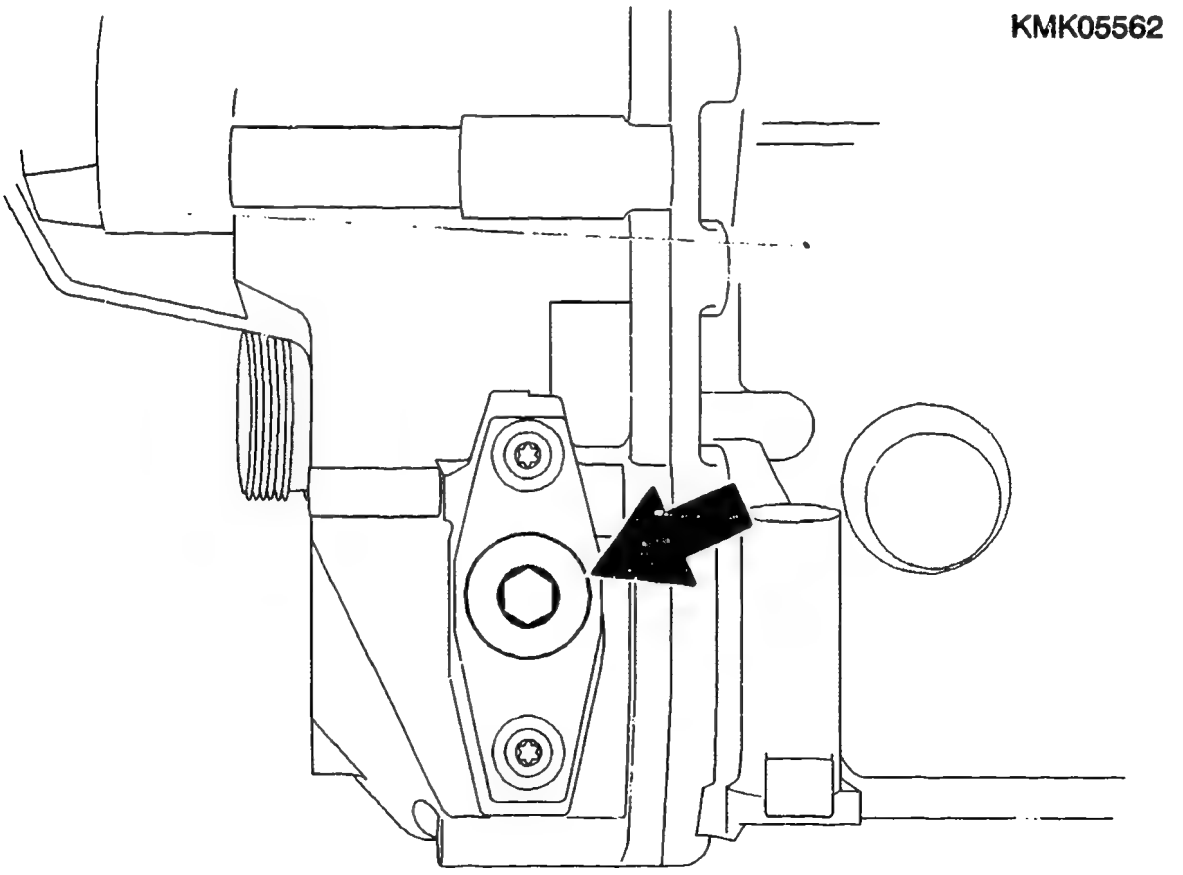


POSITIONER ASSEMBLY

If this value is not correct, dimension "X" has been incorrectly calibrated (thrust pin in servo-magnet armature) and the procedure is thus to be repeated (measurement of dimension "X").

Proceed as follows if disk cam assignment has already been performed in line with H-pump test instructions: Pour approx. 100 cm3 of SAE 20 W 20 oil into positioner by way of lateral start of delivery hole in housing or in adjusting flange (arrow). This must be done prior to start-up as otherwise the heat of friction will destroy the oil pump.

Continue: A01/1 Fig.: D22/2



INDEX

Adjusting dimension "X":
thrust-pin/control-rod
clearance..... D08/2
Checking electrical
positioner connections, inner.. B22/1
Checking electrical
positioner connections, outer.. B26/1
Checking position of RPS
short-circuiting ring..... B07/1
Component fastening
screws..... C07/1
Dimension "X": Check with
positioner attached..... D21/1
Disk cam assessment..... B14/1
Disk cam installation
instructions..... D08/1

Continue: N25/2

INDEX

Disk cam removal..... B06/1
Drive coupling installation.... B02/1
Installation position
of soldering eyes..... C26/1
Installing injection
pump on assembly stand..... B01/1
Lead colors - positioner..... C28/1
Lead routing - positioner..... D01/1
Measurement of positioner
component resistance..... C01/1
Positioner attachment to
pump..... D16/1
Positioner housing assessment.. B15/1
Positioner repair -
general..... C06/1

Continue: N26/1

INDEX

Prestroke solenoid
functional test..... B19/1
Prestroke solenoid
replacement..... C10/1
RE positioner removal..... B03/1
RPS mechanical testing..... C20/1
RPS replacement..... C12/1
Schlemmer plug -
plug assignment..... C03/1
Schlemmer plug -
plug installation..... C20/1
Servo-magnet - checking
bushing wear..... B17/2
Servo-magnet - checking
freedom of movement..... B16/1

Continue: N26/2

INDEX

Servo-magnet replacement..... C08/1
Soldering specification
for 7-pin plug plate..... C23/1
Terminal board (7-pin)
replacement..... C16/1
Viscous oil pump assessment.... B12/1
Viscous oil pump
installation..... D04/1
Viscous oil pump
installation instructions..... B13/1
Viscous oil pump removal..... B06/1

Continue: N27/1

TABLE OF CONTENTS

Structure of microcard	A01/1
Special features	A03/1
General	A05/1
Safety measures	A08/1
Testers, fixtures and tools	A10/1
Test specifications	A15/1
Adhesives and lubricants	A17/1
Tightening torques	A18/1

Continue: N27/2

TABLE OF CONTENTS

Positioner disassembly	B01/1
Component cleaning and checking	B10/1
Positioner housing - testing	B15/1
Positioner housing - repair	C05/1
Positioner assembly	D03/1
Index	N25/1

Continue: N28/1

EDITORIAL NOTE

Copyright 1994 ROBERT BOSCH GmbH
Automotive-Equipment After-Sales Service
Technical Publications Department
KH/VDT,
Postfach 30 02 20, D-70422 Stuttgart

Published by:
After-Sales Service Department for Training and
Technology (KH/VSK).
Time of going to press 09.1994.
Please direct questions and comments concerning the contents to our authorized representative in your country.

Continue: N28/2

EDITORIAL NOTE

The contents of this microcard are intended only for the Bosch Franchised After-Sales Organization. Passing on to third parties is not permitted.

Microfilmed in the Federal Republic of Germany.

Microphotographié en République Fédérale d'Allemagne.

Continue: A01/1